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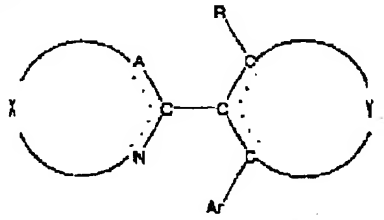
(54) ELECTROLUMINESCENT MATERIAL, ELECTROLUMINESCENT ELEMENT AND COLOR TRANSFORMATION FILTER

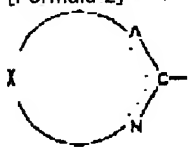
(57)Abstract:
PROBLEM TO BE SOLVED: To provide high luminance and shelf life electroluminescent element and highly luminescent color filter based on that electroluminescent element by using inorganic and/or rare-earth complex based phosphor.
SOLUTION: An electroluminescent element characterized by containing at least a kind of electroluminescent material and an inorganic based phosphor that absorbes the luminescent light from that electroluminescent material and luminescences at peak wavelength different from the peak wavelength of that electroluminescent material.

CLAIMS

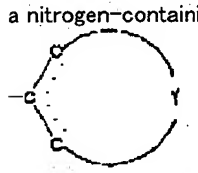
[Claim(s)]
[Claim 1]Electroluminescence material characterized by what is expressed with a following general formula (N1).
[Formula 1]
一般式（Ｎ１）



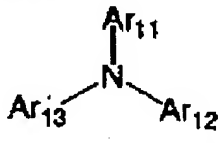
[Ar expresses an aryl group among a formula and A expresses a carbon atom, a nitrogen atom, a sulfur atom, or an oxygen atom, X expresses an atomic group required to form the nitrogen-containing aromatic heterocycle of 5 members or 6 members with A and N, Y expresses an atomic group required to form the aromatic hydrocarbon rings or the aromatic heterocycle of 5 members or 6 members with three carbon atoms, the C-N combination in a formula, C-A combination, and C-C combination express a single bond or a double bond, and R expresses a hydrogen atom, a substituent, or Ar. Further
[Formula 2]



a nitrogen-containing aromatic heterocycle come out of and expressed — and [Formula 3]



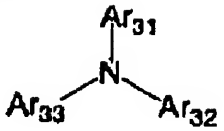
It could come out and the aromatic hydrocarbon rings or the aromatic heterocycle expressed may be further condensed according to a hydrocarbon ring or heterocycle.]
[Claim 2]Electroluminescence material characterized by what is expressed with a following general formula (A1).
[Formula 4]
一般式（Ａ１）



[A beer reel group with the bond axis which can give at least two internal rotation opposite-sex nature exists in the intramolecular of a compound which Ar_{11}, Ar_{12}, and Ar_{13} express an aryl group or an aromatic heterocycle group, and is expressed with a general formula (A1) among a formula.]
[Claim 3]The electroluminescence material according to claim 2 characterized by what is expressed with a following general formula (A2).
[Formula 5]
一般式（Ａ２）

[Ar_{21}, Ar_{22}, and Ar_{23} express among a formula the beer reel which has a bond axis which can give internal rotation opposite-sex nature independently, respectively.]
[Claim 4]Electroluminescence material given in claim 2 or any of 3 they are. [which is characterized by what is expressed with a following general formula (A3)]
[Formula 6]

一般式（A３）

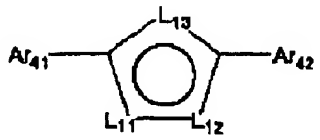


Ar_{31}, Ar_{32}, and Ar_{33} express an aryl group or an aromatic heterocycle group independently among [type, respectively — and the inside of Ar_{31}, Ar_{32}, and Ar_{33} — at least two — 1 and 1' — the aryl group which has - binaphthyl group is expressed.]

[Claim 5]Electroluminescence material characterized by what is expressed with a following general formula (B1).

[Formula 7]

一般式（Ｂ１）

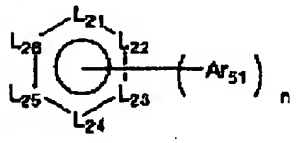


[Ar_{41} and Ar_{42} express an aryl group or an aromatic heterocycle group independently among a formula, respectively, L_{11}, L_{12}, and L_{13} express an atomic group required to form the aromatic heterocycle of 5 members, At least one of L_{11}, L_{12}, and L_{13} expresses =N-, $-N(R_{41})-$, -S-, or -O-, and R_{41} expresses a hydrogen atom or a substituent. However, at least one of Ar_{41}, Ar_{42}, and R_{41} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]

[Claim 6]Electroluminescence material characterized by what is expressed with a following general formula (C1).

[Formula 8]

一般式（Ｃ１）

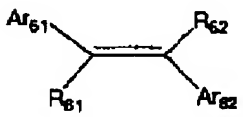


[Ar_{51} expresses an aryl group or an aromatic heterocycle group among a formula, n expresses the integer of 0 to 6, and when n is two or more, two or more Ar_{51} may be the same, or may differ, L_{21}, L_{22}, L_{23}, L_{24}, L_{25} and L_{26} express an atomic group required to form the nitrogen-containing aromatic heterocycle of 6 members, At least one of L_{21}, L_{22}, L_{23}, L_{24}, L_{25}, and L_{26} expresses =N- or $-N(R_{51})-$, and R_{51} expresses a hydrogen atom or a substituent. However, at least one of Ar_{51} and R_{51} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]

[Claim 7]Electroluminescence material characterized by what is expressed with a following general formula (D1).

[Formula 9]

一般式（Ｄ１）

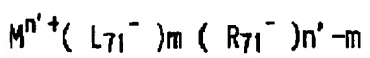


[Ar_{61} and Ar_{62} express an aryl group or an aromatic heterocycle group among a formula, and R_{61} and R_{62} express a hydrogen atom or a substituent. However, at least one of Ar_{61}, Ar_{62}, R_{61}, and R_{62} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]

[Claim 8]Electroluminescence material characterized by what is expressed with a following general formula (E1).

[Formula 10]

一般式（Ｅ１）

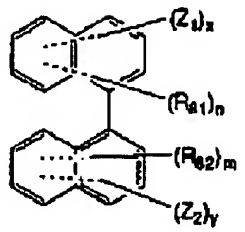


[M expresses among a formula the metallic element which can take an ionic state to tetravalence from univalent, n' expresses the natural number of 1 to 4, and L_{71}^- forms M and an ionic bond, And the univalent anion which has a portion which can be configurated in M is expressed, m is the same as n', or expresses a natural number smaller than it, and R_{71}^- expresses the univalent anion which forms M and an ionic bond. However, at least one of L_{71}^- or the R_{71}^- is a basis which has a beer reel portion with the bond axis which can give internal rotation opposite-sex nature.]

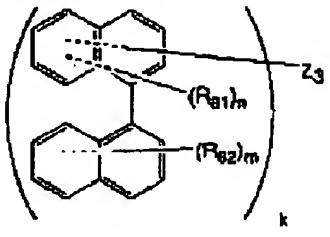
[Claim 9]Electroluminescence material characterized by what is expressed with a following general formula (F1) or (F2).

[Formula 11]

一般式（Ｆ１）



一般式（Ｆ２）

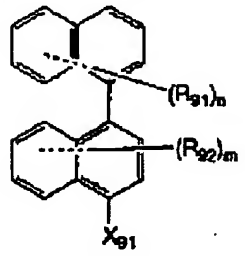


[Z_1 and Z_2 among a formula, Express luminescent univalent compound residue independently, respectively, and Z_3 expresses the luminescent compound residue of k value, k expresses the natural number of 1–8, x expresses the natural number of 1–3, and y expresses the integer of 0–3, When x is two or more, two or more Z_1 may be the same, or it may differ, when y is two or more, two or more Z_2 may be the same, or it may differ, and when both x and y are one or more further, Z_2 may be the same as Z_1, or may differ from each other. R_{81} and R_{82} express a substituent independently, respectively, n expresses the integer of 0–4, m expresses the integer of 0–4, and when n is two or more, two or more R_{81} may be the same, or may differ, It condenses mutually and a ring may be formed, when m is two or more, two or more R_{82} may be the same, or it may differ, and it condenses mutually and a ring may be formed, and when both n and m are one or more further, R_{82} may be the same as R_{81}, or may differ from each other. Each substituent of Z_1, Z_2, R_{81}, and R_{82} may form a naphthalene ring and a condensed ring.]

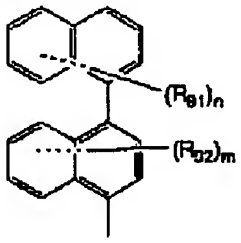
[Claim 10]A compound for organic electroluminescence having a univalent beer reel group which uses for a raw material the 4–halo 1 expressed with a following general formula (G1), and a 1'–binaphthyl derivative, and is expressed with a following general formula (G2) they to be [any of intramolecular].

[Formula 12]

一般式（Ｇ１）



一般式（Ｇ２）



[X_{91} expresses a halogen atom among a formula, and R_{91} and R_{92} express a substituent independently, respectively, When n expresses the integer of 0–4, m expresses the integer of 0–4 and n is two or more, Two or more R_{91} may be the same, may differ, and is condensed mutually, and may form a ring, When m is two or more, two or more R_{92} may be the same, or it may differ, and it condenses mutually and a ring may be formed, and when both n and m are one or more further, R_{92} may be the same as R_{91}, or may differ from each other.]

[Claim 11]Containing at least one sort of inorganic system fluorescent substances which emit light to a different maximum luminous wavelength from a maximum luminous wavelength which absorbs at least one sort of electroluminescence material, and luminescence of this electroluminescence material, and is emitted from this electroluminescence material. An electroluminescent element by which it is characterized.

[Claim 12]The electroluminescent element according to claim 11, wherein said inorganic system fluorescent substance is an inorganic system fluorescent substance manufactured by the Sol–Gel method.

[Claim 13]The electroluminescent element according to claim 11 or 12, wherein a maximum luminous wavelength of said inorganic system fluorescent substance is 400–700 nm.

[Claim 14]An electroluminescent element given in any 1 paragraph of claims 11–13 to which at least one sort of said inorganic system photogen is characterized by a maximum luminous wavelength being 600–700 nm.

[Claim 15]An electroluminescent element containing a rare earth complex system fluorescent substance which emits light to a different maximum luminous wavelength from a maximum luminous wavelength which absorbs luminescence of electroluminescence material and this electroluminescence material, and is emitted from this electroluminescence material.

[Claim 16]The electroluminescent element according to claim 15, wherein a maximum luminous wavelength of said rare earth complex system fluorescent substance is 400–700 nm.

[Claim 17]An electroluminescent element given in claim 15 to which at least one sort of said rare earth complex system photogen is characterized by a maximum luminous wavelength being 600–700 nm, or any 1 paragraph of 16.

[Claim 18]An electroluminescent element given in any 1 paragraph of claims 11–17, wherein a maximum luminous wavelength of said electroluminescence material is 430 nm or less.

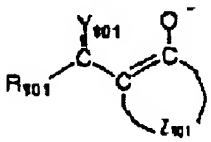
[Claim 19]The electroluminescent element according to claim 18, wherein a maximum luminous wavelength of said electroluminescence material is 400–430 nm.

[Claim 20]An electroluminescent element given in any 1 paragraph of claims 11–19, wherein said electroluminescence material is organic LED.

[Claim 21]An electroluminescent element given in any 1 paragraph of claims 11–19, wherein said electroluminescence material is inorganic LED.

[Claim 22]Said electroluminescence material Said general formula (N1), (A1), The electroluminescent element according to claim 11 to 21 being at least one sort chosen from a compound expressed with (A2), (A3), (B1), (C1), (D1), (E1), (F1), (F2), (G1), or (G2).

[Claim 23]At least one sort of an inorganic system fluorescent substance which absorbs light emitted from a layer and this electroluminescence material which contain electroluminescence material on a base, and has a maximum luminous wavelength in 400–500 nm, An electroluminescent element having a color conversion layer containing at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm.
[Claim 24]At least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from a layer and this electroluminescence material which contain electroluminescence material on a base, and has a maximum luminous wavelength in 400–500 nm, An electroluminescent element having a color conversion layer containing at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm.
[Claim 25]A color conversion filter containing at least one sort of an inorganic system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–700 nm.
[Claim 26]At least one sort of an inorganic system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–500 nm, A color conversion filter containing at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm.
[Claim 27]A color conversion filter given in claim 25, wherein said inorganic fluorescent substance is an inorganic system fluorescent substance manufactured by the Sol–Gel method, or any 1 paragraph of 26.
[Claim 28]A color conversion filter containing at least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–700 nm.
[Claim 29]At least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–500 nm, A color conversion filter having a color conversion layer containing at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm.
[Claim 30]A color conversion method changing light of a short wavelength region into red rather than red using an inorganic system fluorescent substance manufactured by the Sol–Gel method.
[Claim 31]A color conversion method changing light of a short wavelength region into red rather than red using a rare earth complex system fluorescent substance.
[Claim 32]The color conversion method according to claim 31, wherein absorption maximum wavelength of said rare earth complex system fluorescent substance is not less than 340 nm.
[Claim 33]A rare earth complex system fluorescent substance having at least one anionic ligand expressed with a following general formula (R2).
[Formula 13]
一般式（Ｒ２）



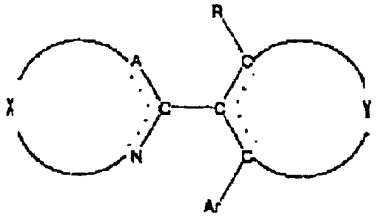
[R_{101} expresses a hydrogen atom or a substituent among a formula, and Y_{101} An oxygen atom, A sulfur atom or $-N(R_{102})-$ is expressed, R_{102} expresses a hydrogen atom or a substituent, and Z_{101} expresses an atomic group required to form four to 8 membered–ring with the double bond of carbon and carbon.]

[Translation done.]

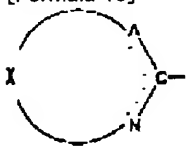
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application]This invention about an electroluminescent element specifically, It is related with the electroluminescent element used suitably [emitted-light type multicolor or a full color display, a display panel, etc.] for the display equipment of a noncommercial use or industrial use, a color image formation method, and a light filter.
[0002]
[Description of the Prior Art]There are emitted type of light and received type of light in an electronic display device, and CRT (cathode-ray tube), PDP (plasma display), ELD (electroluminescence display), VFD (fluorescent display), etc. are mentioned as emitted type of light, for example.
[0003]ELD is explained in this.
[0004]With ELD (electroluminescence display). Two or more light emitting devices which consist of material which emits light by the electric field or an electric field, or they are combined, and there are a career pouring type with which organicity and inorganic matter used the recombination of an electron and an electron hole, and an acceleration electron type using the collision energy of the acceleration electron as luminescent mechanism further as a material. While it is longer-life than organicity and inorganic matter is generally more stable in material, the developed width of material is narrow and a molecular design has restriction. Generally there is an advantage [direction / of a recombined type] that driver voltage is lower than an acceleration electron type, mechanistically, and career pouring type ELD is briskly studied from the advantage in recent years.
[0005]As an ELD material, there are specifically the following three kinds.
[0006]** Inorganic LED (material comprises inorganic compounds, such as GaN and GaInN, and luminescent mechanism is a recombined type.) It is only referred to also as LED (light emitting diode).
** Organic LED (doria material comprising organic compounds, such as a reel amine derivative and a stilbene derivative, luminescent mechanism recombined type.) It is referred to also as organic electroluminescence (electroluminescent element) and OLED.
** Inorganic EL (material comprises inorganic compounds, such as ZnS:Mn and ZnS:Tb, and luminescent mechanism is an acceleration electron type.) Rather than organic electroluminescence D, since history is old, it may only be called electroluminescence (EL) here.
In this, the "electroluminescent elements" said by this invention is ** and **, and "electroluminescence material" shows the thing of the material which constitutes ** and **. Therefore, the above-mentioned ** is excepted from this invention.
[0007]Since the thin film which consists of organic compounds comes to be used for the career pouring type organic electroluminescence element which attracts attention especially in recent years, what has large luminescence intensity has come to be obtained. For example, the thing which used single crystal anthracene etc. for U.S. Pat. No. 3,530,325 as a photogen, What combined the hole injection layer and the organic luminous body layer with JP,59-194393,A, What combined the hole injection layer and the organic electron injection transporting bed with JP,63-295695,A, Jpn.Journal of Applied Phisycs, vol127, and No.2 — what combined the electron hole moving bed, the luminous layer, and the electronic transition layer with the 269-271st page is indicated, respectively, and luminescence intensity has been improved by these.
[0008]******** which absorbs luminescence of the above-mentioned electroluminescence material and makes fluorescence emit light on the other hand is known. About the method of making multicolor fluorescence emitting light from a certain electroluminescence material, it is applied to CRT, PDP, VFD, etc. using this fluorescent substance. However, it is high in energy, namely, that a luminous wavelength is short wave poses a problem — there is luminescence of electroluminescence material by the electron beam or a far ultraviolet ray in this case. That is, although the above-mentioned fluorescent substance is specifically an inorganic fluorescent substance and many things which can be very highly [about stability] equal to long-term use are also known, The actual condition was that there is almost nothing that excited wavelengths excite to the long wavelength of calling it a visible region from near-ultraviolet, in an inorganic fluorescent substance, and there is. [that emits light especially in red light]
[0009]Although it is presumed that the near ultraviolet ray with possible making light emit from electroluminescence material is light with a maximum luminous wavelength of about 350 nm - about 400 nm, Using organic fluorescent dye as a fluorescent substance excited by such a near ultraviolet ray is known for JP,3-152897,A, 9-245511, 5-258860, etc.
[0010]However, generally, organic fluorescent dye tends to receive influence in the surrounding environment, and according to for example, the kind of media, such as a solvent and resin, etc. The fluorescence wavelength may change (discoloration), or optical quenching may be started, it is very more unstable still to light or heat, for example, under an about 100,000 luxs strong light, it is most which is decomposed from several minutes in about several hours, and the organic fluorescent dye which can be equal to a mothball does not exist.
[0011]The blue fluorochrome of a photogen which is, carries out, absorbs the light of a blue-green field, and carries out convert colors to a green field or a red region is used for the method indicated to said patent.
The fluorescence conversion film which shows a fluorescence of green regions has a small Stokes shift (difference of an absorption wavelength and a luminous wavelength), and it ends, And although it has the feature that it is possible to make a part of luminescence of electroluminescence material penetrate, it is comparatively efficient, and the light of a photogen can be changed, the fluorescence to a red spectrum region, Since a big Stokes shift is needed and also light of a photogen can hardly be used, conversion efficiency is remarkably low.

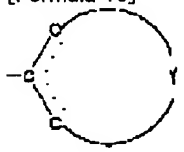
Optical – light conversion (photoluminescence) of two or more fluorochromes needed to be used for other stages like the fluorochrome which uses together the fluorochrome from which several kinds of excited wavelengths specifically differ, for example, becomes yellow in response to blue glow, and the fluorochrome which shines in red in response to yellow, and efficient[on a principle]-izing was impossible.
[0012]therefore, in a Prior art, there were problems also including the problem of previous discoloration, brightness lowering, and optical quenching that the balance of blue and green and red light emitting luminance is bad, and red luminosity could not but be low and could not but become a low-intensity colored presentation with visibility bad on the whole especially.
[0013]
[Problem(s) to be Solved by the Invention]Wholeheartedly, as a result of examination, by using an inorganic system fluorescent substance and/or a rare earth complex system fluorescent substance, this invention persons were high-intensity, and come to get a highly preservable electroluminescent element, and came to provide the light filter with high luminosity by application of this electroluminescent element.
[0014]
[Means for Solving the Problem]This invention persons found out that the above-mentioned purpose could be attained with the following composition, as a result of stepping up efforts wholeheartedly.
(1) Electroluminescence material characterized by what is expressed with a following general formula (N1), [0015]
[Formula 14]
一般式（Ｎ１）



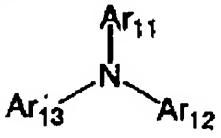
[0016][Ar expresses an aryl group among a formula and A expresses a carbon atom, a nitrogen atom, a sulfur atom, or an oxygen atom, X expresses an atomic group required to form the nitrogen-containing aromatic heterocycle of 5 members or 6 members with A and N, Y expresses an atomic group required to form the aromatic hydrocarbon rings or the aromatic heterocycle of 5 members or 6 members with three carbon atoms, the C-N combination in a formula, C-A combination, and C-C combination express a single bond or a double bond, and R expresses a hydrogen atom, a substituent, or Ar. Further
[0017]
[Formula 15]



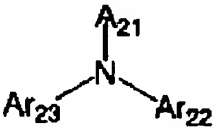
[0018]the nitrogen-containing aromatic heterocycle come out of and expressed — and [0019]
[Formula 16]



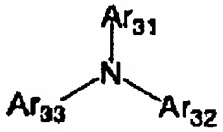
[0020]It could come out and the aromatic hydrocarbon rings or the aromatic heterocycle expressed may be further condensed according to a hydrocarbon ring or heterocycle.]
(2) Electroluminescence material characterized by what is expressed with a following general formula (A1), [0021]
[Formula 17]
一般式（Ａ１）



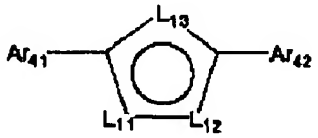
[0022][A beer reel group with a bond axis which can give at least two internal rotation opposite-sex nature exists in intramolecular of a compound which Ar_{11}, Ar_{12}, and Ar_{13} express an aryl group or an aromatic heterocycle group, and is expressed with a general formula (A1) among a formula.]
(3) The electroluminescence material according to claim 2 characterized by what is expressed with a following general formula (A2), [0023]
[Formula 18]
一般式（Ａ２）



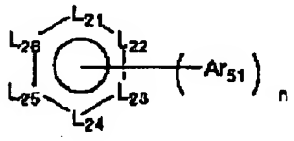
[0024][Ar_{21}, Ar_{22}, and Ar_{23} express among a formula the beer reel which has a bond axis which can give internal rotation opposite-sex nature independently, respectively.]
(4) Electroluminescence material given in claim 2 or any of 3 they are. [which is characterized by what is expressed with a following general formula (A3)]
[0025]
[Formula 19]
一般式（Ａ３）



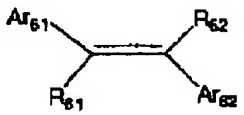
[0026][Ar_{31}, Ar_{32}, and Ar_{33} express an aryl group or an aromatic heterocycle group independently among [type, respectively — and inside of Ar_{31}, Ar_{32}, and Ar_{33} — at least two — 1 and 1' — an aryl group which has - binaphthyl group is expressed.]
(5) Electroluminescence material characterized by what is expressed with a following general formula (B1), [0027]
[Formula 20]
一般式（Ｂ１）



[0028][Ar_{41} and Ar_{42} express an aryl group or an aromatic heterocycle group independently among a formula, respectively, L_{11}, L_{12}, and L_{13} express an atomic group required to form the aromatic heterocycle of 5 members, At least one of L_{11}, L_{12}, and L_{13} expresses =N-, $-N(R_{41})-$, -S-, or -O-, and R_{41} expresses a hydrogen atom or a substituent. However, at least one of Ar_{41}, Ar_{42}, and R_{41} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]
(6) Electroluminescence material characterized by what is expressed with a following general formula (C1).
[0029]
[Formula 21]
一般式（Ｃ１）



[0030][Ar_{51} expresses an aryl group or an aromatic heterocycle group among a formula, n expresses the integer of 0 to 6, and when n is two or more, two or more Ar_{51} may be the same, or may differ, L_{21}, L_{22}, L_{23}, L_{24}, L_{25} and L_{26} express an atomic group required to form the nitrogen-containing aromatic heterocycle of 6 members, At least one of L_{21}, L_{22}, L_{23}, L_{24}, L_{25}, and L_{26} expresses =N- or $-N(R_{51})-$, and R_{51} expresses a hydrogen atom or a substituent. However, at least one of Ar_{51} and R_{51} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]
(7) Electroluminescence material characterized by what is expressed with a following general formula (D1), [0031]
[Formula 22]
一般式（Ｄ１）



[0032][Ar_{61} and Ar_{62} express an aryl group or an aromatic heterocycle group among a formula, and R_{61} and R_{62} express a hydrogen atom or a substituent. However, at least one of Ar_{61}, Ar_{62}, R_{61}, and R_{62} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]
(8) Electroluminescence material characterized by what is expressed with a following general formula (E1), [0033]
[Formula 23]
一般式（Ｅ１）

$$M^{n'+}(L_{71}^{-})_m(R_{71}^{-})_{n'-m}$$

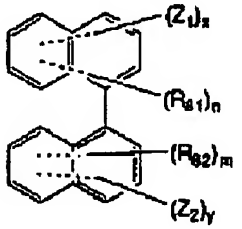
[0034][M expresses among a formula a metallic element which can take an ionic state to tetravalence from univalent, n'

expresses a natural number of 1 to 4, and L_{71}^{-} forms M and an ionic bond, And a univalent anion which has a portion which can be configurated in M is expressed, m is the same as n', or expresses a natural number smaller than it, and R_{71}^{-} expresses a univalent anion which forms M and an ionic bond. However, at least one of L_{71}^{-} or the R_{71}^{-} is a basis which has a beer reel portion with a bond axis which can give internal rotation opposite-sex nature.]

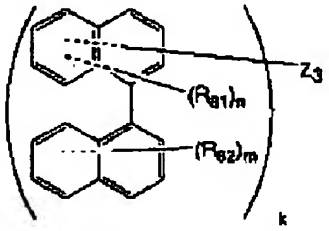
(9) Electroluminescence material characterized by what is expressed with a following general formula (F1) or (F2), [0035]

[Formula 24]

一般式 (F 1)



一般式 (F 2)

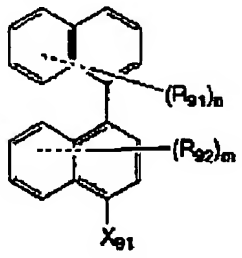


[0036][Z_1 and Z_2 among a formula, Express luminescent univalent compound residue independently, respectively, and Z_3 expresses the luminescent compound residue of k value, k expresses the natural number of 1-8, x expresses the natural number of 1-3, and y expresses the integer of 0-3, When x is two or more, two or more Z_1 may be the same, or it may differ, when y is two or more, two or more Z_2 may be the same, or it may differ, and when both x and y are one or more further, Z_2 may be the same as Z_1, or may differ from each other. R_{81} and R_{82} express a substituent independently, respectively, n expresses the integer of 0-4, m expresses the integer of 0-4, and when n is two or more, two or more R_{81} may be the same, or may differ, It condenses mutually and a ring may be formed, when m is two or more, two or more R_{82} may be the same, or it may differ, and it condenses mutually and a ring may be formed, and when both n and m are one or more further, R_{82} may be the same as R_{81}, or may differ from each other. Each substituent of Z_1, Z_2, R_{81}, and R_{82} may form a naphthalene ring and a condensed ring.]

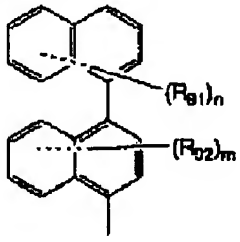
(10) A compound for organic electroluminescence having a univalent beer reel group which uses for a raw material the 4-halo 1 expressed with a following general formula (G1), and a 1'-binaphthyl derivative, and is expressed with a following general formula (G2) they to be [any of intramolecular], [0037]

[Formula 25]

一般式 (G 1)



一般式 (G 2)



[0038][X_{91} expresses a halogen atom among a formula, and R_{91} and R_{92} express a substituent independently, respectively, When n expresses the integer of 0-4, m expresses the integer of 0-4 and n is two or more, Two or more R_{91} may be the same, may differ, and is condensed mutually, and may form a ring, When m is two or more, two or more R_{92} may be the same, or it may differ, and it condenses mutually and a ring may be formed, and when both n and m are one or more further, R_{92} may be the same as R_{91}, or may differ from each other.]

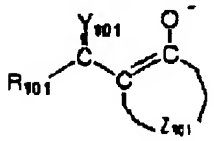
(11) An inorganic system fluorescent substance which emits light to a different maximum luminous wavelength from a maximum luminous wavelength which absorbs at least one sort of erection loss MINESSENSU material, and luminescence of this electroluminescence material, and is emitted from this electroluminescence material. An electroluminescent element containing at least one sort, (12) The electroluminescent element according to claim 11, wherein said inorganic system fluorescent substance is an inorganic system fluorescent substance manufactured by the Sol-Gel method, (13) The electroluminescent element according to claim 11 or 12, wherein a maximum luminous wavelength of said inorganic system fluorescent substance is 400-700 nm, (14) An electroluminescent element given in any 1 paragraph of claims 11-13 to which at least one sort of said inorganic system photogen is characterized by a maximum luminous wavelength being 600-700 nm, (15) An electroluminescent element containing a rare earth complex system fluorescent substance which emits light to a different maximum luminous wavelength from a maximum luminous wavelength which absorbs luminescence of erection loss MINESSENSU material and this electroluminescence material, and is emitted from this electroluminescence material, (16) The electroluminescent element according to claim 15, wherein a maximum luminous wavelength of said rare earth complex system fluorescent substance is 400-700 nm, (17) An electroluminescent element given in claim 15 to which at least one sort of said rare earth complex system photogen is characterized by a maximum luminous wavelength being 600-700 nm, or any 1 paragraph of 16, (18) An electroluminescent element given in any 1 paragraph of claims 11-17, wherein a maximum luminous wavelength of said electroluminescence material is 430 nm or less, (19) The electroluminescent element according to claim 18, wherein a maximum luminous wavelength of said electroluminescence material is 400-430 nm, (20) An electroluminescent element given in any 1 paragraph of claims 11-19, wherein said electroluminescence material is organic LED, (21) an electroluminescent element given in any 1 paragraph of claims 11-19, wherein said electroluminescence material is inorganic LED, and (22) — said electroluminescence material — said general formula (N1), (A1), (A2), (A3), and

(B1). The electroluminescent element according to claim 11 to 21 being at least one sort chosen from a compound expressed with (C1), (D1), (E1), (F1), (F2), (G1), or (G2), (23) At least one sort of an inorganic system fluorescent substance which absorbs light emitted from a layer and this electroluminescence material which contain electroluminescence material on a base, and has a maximum luminous wavelength in 400–500 nm, On an electroluminescent element having a color conversion layer containing at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm, and (24) bases, At least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from a layer and this electroluminescence material containing electroluminescence material, and has a maximum luminous wavelength in 400–500 nm, An electroluminescent element having a color conversion layer containing at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm, (25) A color conversion filter containing at least one sort of an inorganic system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–700 nm, (26) At least one sort of an inorganic system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–500 nm, A color conversion filter containing at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm, (27) A color conversion filter given in claim 25, wherein said inorganic fluorescent substance is an inorganic system fluorescent substance manufactured by the Sol–Gel method, or any 1 paragraph of 26, (28) A color conversion filter containing at least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–700 nm, (29) At least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–500 nm, A color conversion filter having a color conversion layer containing at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm, (30) A color conversion method changing light of a short wavelength region into red rather than red using an inorganic system fluorescent substance manufactured by the Sol–Gel method, (31) A color conversion method changing light of a short wavelength region into red rather than red using a rare earth complex system fluorescent substance, (32) A rare earth complex system fluorescent substance having the color conversion method according to claim 31, wherein absorption maximum wavelength of said rare earth complex system fluorescent substance is not less than 340 nm, and at least one anionic ligand expressed with (33) following general formulas (R2).

[0039]

[Formula 26]

一般式（Ｒ２）



[0040][R_{101} expresses a hydrogen atom or a substituent among a formula, and Y_{101} An oxygen atom, A sulfur atom or –N(R_{102})– is expressed, R_{102} expresses a hydrogen atom or a substituent, and Z_{101} expresses an atomic group required to form four to 8 membered–ring with the double bond of carbon and carbon.]

This invention is explained in detail below.

[0041]In this invention, with electroluminescence material. It is the material which emits light by the electric field or an electric field, and from the anode and the negative pole, an electron hole and an electron are poured in, respectively, and it is the material which emits light when [in which they recombine] carrying out, and specifically differs from the material by the collision energy of an acceleration electron which emits light (what is called inorganic electroluminescence).

[0042]On both sides of a luminous layer, it has a counterelectrode of a couple as emitting light by the electric field or an electric field, and the electroluminescence material contained in this luminous layer by sending current through this electrode emits light. The electron poured in from one electrode of the counterelectrode of a couple in which this sandwiched the luminous layer, Recombination happens within a luminous layer by the electron hole poured in from another electrode, When electroluminescence material is excited by the higher energy level and the excited electroluminescence material returns to the original ground state, it is thought that it happens by releasing energy as a light.

[0043]Electroluminescence material used for this invention, As long as it emits light by electric field or an electric field, there may not be any restriction in particular, for example, an inorganic electroluminescence material (it is also called inorganic LED) like gallium nitride (GaN) may be sufficient, Although you may be any of an organic electroluminescence material (it is also called organic LED), it is preferred from a point of luminous efficiency to use organic LED.

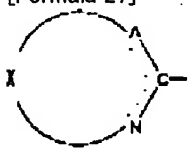
[0044]In this invention, as for electroluminescence material, it is preferred that it is what has a maximum luminous wavelength in 430 nm or less by electric field or an electric field, and also it is preferred that it is what has a maximum luminous wavelength in 400–430 nm.

[0045]On a CIE chromaticity diagram table, it is the 4th ** of a new edition color science handbook. Edited by Color Science Association of Japan Inside of "relation between a color name of drawing 4 .16 color stimulus (color of light), and a chromaticity coordinate" indicated to the 108th page Purplish Blue, It is preferred that it is a field of Blueish Purple or Purple.

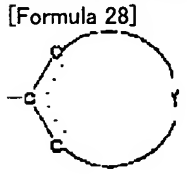
[0046]Electroluminescence material preferably used for this invention is explained concretely.

[0047]Electroluminescence material preferably used for this invention, The aforementioned general formula (N1), (A1), (A2), (A3), (B1), the 4–halo 1 expressed with a compound expressed with (C1), (D1), (E1), (F1), and (F2), and (G1), and a 1'–binaphthyl derivative — as a raw material — using (G2) — a compound which has a univalent beer reel group with which it is expressed in either of the intramoleculars is raised.

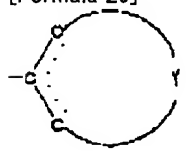
[0048]In a general formula (N1), (A1), (A2), (A3), (B1), (C1), and (D1), Ar, Ar_{11}, Ar_{12}, Ar_{13}, Ar_{21}, Ar_{22}, Ar_{23}, Ar_{31}, Ar_{32}, As long as the number of pi electrons of an aryl group expressed with Ar_{33}, Ar_{41}, Ar_{42}, Ar_{51}, Ar_{61}, and Ar_{62} is 4n+2 (n is a natural number), there may not be any restriction in particular and a monocycle or a condensed ring may be sufficient. Furthermore, by a substituent, this aryl group may be replaced and as the substituent which may be replaced, An alkyl group, a cycloalkyl group, an alkenyl group, an alkynyl group, an aryl group, A heterocycle group, an amino group, a halogen atom, a hydroxyl group, a sulfhydryl group, a carboxyl group, the acylamino group, a sulfonamide group, a HOSUHON amide group, a carbamoyl group, an ester group, an alkoxy group, an aryloxy group, a nitro group, a cyano group, a silyl group, etc. are mentioned. When two or more substituents replace by a place where this aryl group adjoins mutually, it may condense mutually, a hydrocarbon ring or heterocycle may be formed, and there may be a portion which has spiro structure further.
[0049]In a general formula (N1), (A1), (A2), (A3), (B1), (C1), and (D1), Ar, Ar_{11}, Ar_{12}, Ar_{13}, Ar_{21}, Ar_{22}, Ar_{23}, Ar_{31}, Ar_{32}, With an aromatic heterocycle group expressed with Ar_{33}, Ar_{41}, Ar_{42}, Ar_{51}, Ar_{61}, and Ar_{62}. The number of pi electrons expresses what removed one hydrogen atom from arbitrary positions of a heterocyclic compound of a monocycle which is 4n+2 (n is a natural number), or a condensed ring, For example, as a heterocyclic compound applicable to it, A franc, a thiophene, pyrrole, imidazole, a pyrazole, 1,2,4-triazole, 1,2,3-triazole, oxazol, a thiazole, an isoxazole, isothiazole, furazan, pyridine, pyrazine, pyrimidine, pyridazine, 1,3,5-triazine, etc. are mentioned, and these heterocycles may form a condensed ring further.
[0050]In a general formula (B1), (C1), (D1), (E1), (F1), (F2), (G1), and (G2), R_{41}, R_{51}, R_{61}, R_{62}, As a substituent expressed with R_{71}, R_{81}, R_{82}, R_{91}, and R_{92}, If replaceable, there will be no restriction in particular, but typically An alkyl group, a cycloalkyl group, An alkenyl group, an alkynyl group, an aryl group, a heterocycle group, an amino group, a halogen atom, A hydroxyl group, a sulfhydryl group, a carboxyl group, the acylamino group, a sulfonamide group, a HOSUHON amide group, a carbamoyl group, an ester group, an alkoxy group, an aryloxy group, a nitro group, a cyano group, a silyl group, etc. are mentioned. When two or more substituents replace by a place which adjoins mutually in this substituent, it may condense mutually, a hydrocarbon ring or heterocycle may be formed, and there may be a portion which has spiro structure further.
[0051]In a general formula (N1), [0052]
[Formula 27]



[0053]Come out, and as a nitrogen-containing heterocycle group expressed, the aromatic heterocycle of a 6pi system of 5 members or 6 members is preferred, and specifically, 2-pyridyl group, 2-pyrimidyl group, 6-pyrimidyl group, 2-pyrazyl group, 3-pyridazyl group, 2-oxazolyl group, 2-thiazolyl group, 3-isoxazolyl group, A 3-isothiazolyl group, 3-furazanyl group, 3-pyrazolyl group, 2-imidazolyl group, 4-imidazolyl group, 2-pyrrolo group, 2-oxadiazolyl group, 2-thiadiazolyl group, 2-(1, 2, 4-triazoryl) basis, 2-(1, 3, 5-triazyl) basis, 3-(1, 2, 4-triazyl) basis, etc. are mentioned. Furthermore, this nitrogen-containing heterocycle may be replaced by the substituent explained for example, by R_{41}, Furthermore, condensed rings (for example, 6-(1H-pyrazolo [5 and 1-c], and [1, 2, 4] triazoryl) basis etc. which made 2-quinolyl group and 3-pyrazolyl group which made 2-pyridyl group condense a hydrocarbon ring condense heterocycle) may be formed.
[0054]In a general formula (N1), [0055]
[Formula 28]



[0056]Come out and the aromatic-hydrocarbon-rings group with which it is expressed removes one hydrogen atom of arbitrary positions from the aromatic hydrocarbon compound of a 4n+2pi system, Specifically, a phenyl group, 1-naphthyl group, 2-naphthyl group, 9-anthryl group, 1-anthryl group, 9-phenan tolyl group, 2-TORIFENIRENIRU group, 3-peri RENIRU group, etc. are mentioned. Furthermore, this hydrocarbon ring may be replaced by the substituent explained for example, by R_{41}, and may form further condensed rings (for example, 9-pyrenyl group which made 9-phenan tolyl group condense a hydrocarbon ring, 8-quinolyl group which made the phenyl group condense heterocycle, etc.).
[0057]In a general formula (N1), [0058]
[Formula 29]



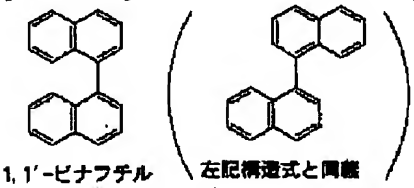
[0059]If at least both contiguity of a portion combined with a nitrogen-containing aromatic heterocycle is carbon atoms and an aromatic heterocycle group expressed is an aromatic group of a 4n+2pi system, will come out, and there will be no restriction in particular, and specifically, 3-pyridyl group, 5-pyrimidyl group, 4-pyridazyl group, 5-pyridazyl group, 4-isoxazolyl group, a 4-isothiazolyl group, 4-pyrazolyl group, 3-pyrrolo group, 3-furil group, 3-thienyl group, etc. are mentioned. Furthermore, this heterocycle may be replaced by substituent explained for example, by R_{41}, and may form a condensed ring further.
[0060]With "a bond axis which can give internal rotation opposite-sex nature" indicated to a general formula (A1), (A2), (B1), (C1), (D1), (E1), (F1), and (F2). For example, like a bond axis which connects a naphthalene nucleus and a naphthalene nucleus of the following 1 and 1'-binaphthyl, A bond axis which cannot perform 360 free rotation according to steric

exclusion under ordinary temperature ordinary pressure is meant, and if 360 free rotation cannot be performed when a CPK model is constructed for convenience, it can be said that the bond axis is "a bond axis which can give internal rotation opposite-sex nature."

[0061]Although an isomer exists in a compound which has "a bond axis which can give internal rotation opposite-sex nature" and the isomer is called an "atropisomer" or "internal rotation optical isomer" (chemicals great dictionary volume [6th] 588th page KYORITSU SHUPPAN), Conversely, if it says, with a compound (or substituent) with "a bond axis which can give internal rotation opposite-sex nature", it can also be put in another way as a compound (or substituent) in which an "atropisomer" or an "internal rotation optical isomer" exists.

[0062]

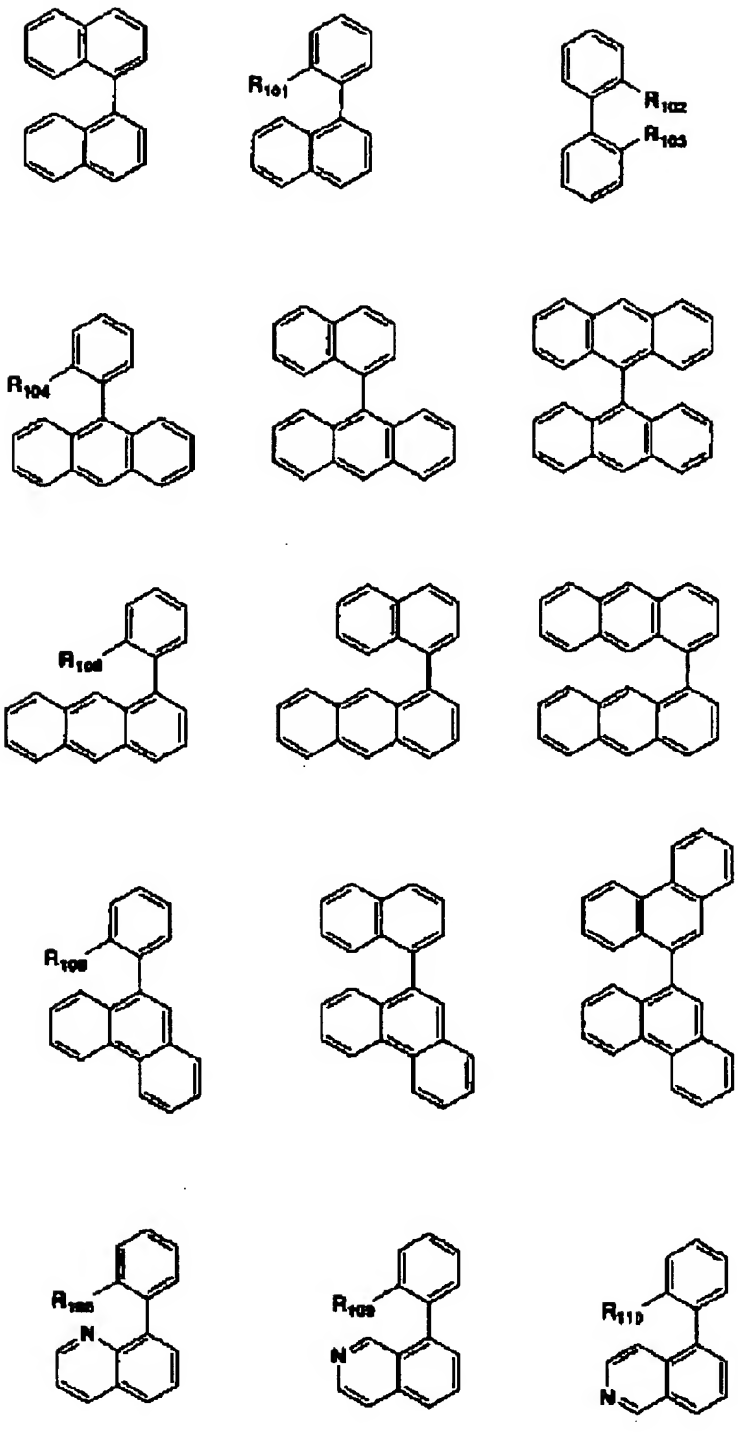
[Formula 30]



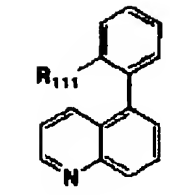
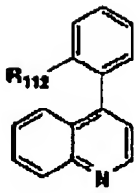
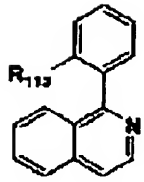
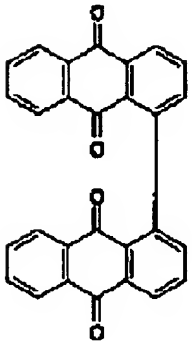
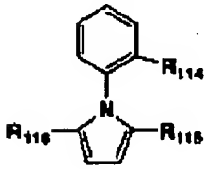
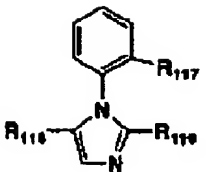
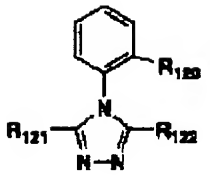
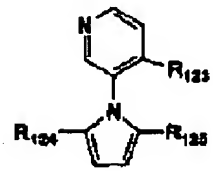
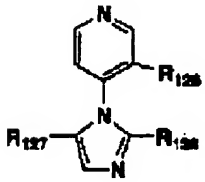
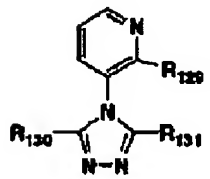
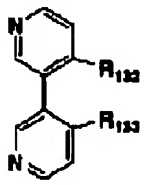
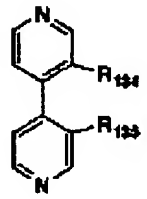
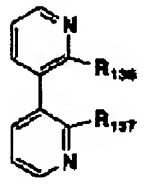
[0063]The basic skeleton of a substituent which has below "a beer reel group with the bond axis which can give internal rotation opposite-sex nature" (what removed the hydrogen atom of arbitrary positions serves as a substituent from the compound shown by a diagram.) The basic skeleton may be replaced by substituent which was further explained by R_{41}, and may form a condensed ring further. Although an example is shown, this invention is not limited to these.

[0064]

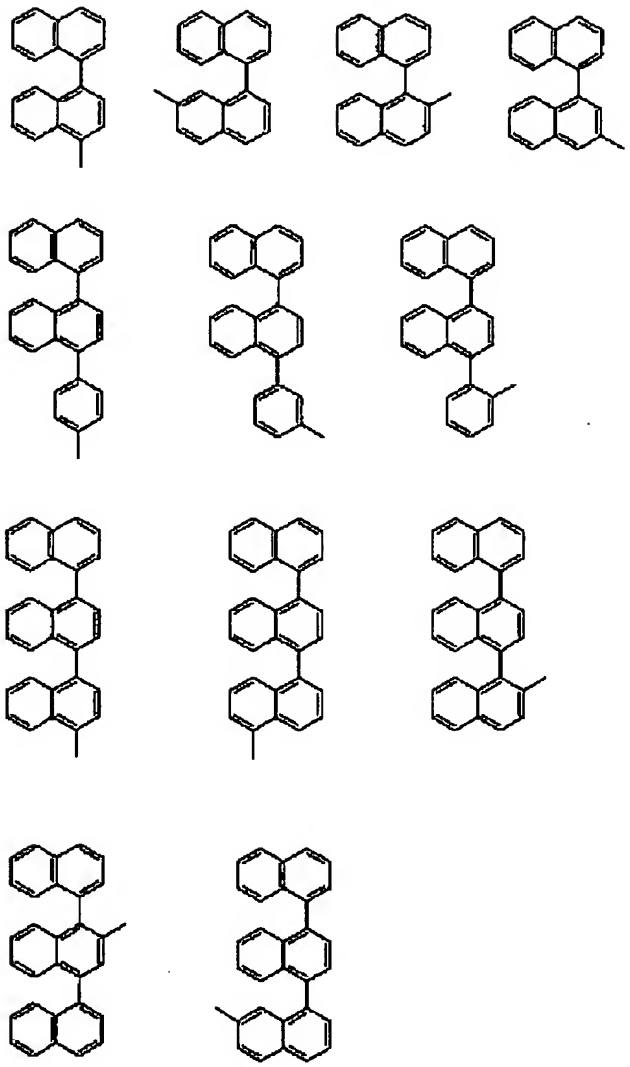
[Formula 31]



[0065]
[Formula 32]

[0066]
[Formula 33]



[0067]The metallic element expressed with M in a general formula (E1), If tetravalent ionic geometry can be taken from univalent, there will be no restriction in particular, but. Be, Mg, Ca, Sr, Ba, Zn, Cd, Hg, Pd, Cu, B, aluminum, Ga, In, Tl, Si, and germanium are preferred, Be, Mg, Ca, Sr, Ba, Zn, Cu, B, aluminum, Ga, and In are still more preferred, and Be, aluminum, Zn, and Ga are the most preferred.

[0068]A univalent anion which has a portion which can form M and an ionic bond which are expressed with L_{71}^- in a general formula (E1), and can be configurated in M, . The state where a proton was added on an oxygen atom, a sulfur atom, or a nitrogen atom in the state of acidity can be taken. Namely, a thing of a form where one proton was taken from a compound which has a dissociative group (-OH, -NH, -SH) is shown, and 2 thru/or 3-atom partition ****** from this oxygen atom, a sulfur atom, or a nitrogen atom — a nitrogen atom or a chalcogen atom (O.) It has an atom which can be configurated to S, Se, and metal like Te, and a nitrogen anion etc. which took a proton are mentioned from NH of the 1st place of an oxygen anion which took a proton from a hydroxyl group of 8-hydroxyquinoline, and 1H-2-(1-pyrazolyl) imidazole.

[0069]A univalent anion which forms M expressed with R_{71}^-, and an ionic bond in a general formula (E1), If an anion is generated under pH eight or more basic conditions, there will be no restriction in particular, For example, an anion etc. which removed one proton from 4-hydroxy-1,1'-biphenyl, 2-mercaptonaphthalene, 1H-pyrazolo [5,1-c], and [1, 2, 4] triazole are mentioned.

[0070]In a general formula (F1), with luminescent univalent compound residue expressed with Z_1 and Z_2. With luminescent compound residue of k value which expresses what removed a hydrogen atom or one substituent, and is expressed with Z_3 in a general formula (F2), from arbitrary positions of a compound in which luminescence is shown under a room temperature. Firefly luminescence or phosphorescence luminescence may be sufficient as "luminescence" of a compound in which what removed a hydrogen atom or k substituents is expressed from arbitrary positions of a compound in which luminescence is shown under a room temperature, and luminescence is shown under this room temperature.

[0071]As a luminescent compound which can serve as luminescent compound residue, A fluorochrome which has absorption in a visible region like a laser pigment, or a fluorescent compound which has absorption in an ultraviolet region like a fluorescent brightener, A phosphorescence luminescent compound still like a platina complex of porphyrin or a biacetyl may be sufficient, and specifically, For example, Kunio Yagi, Yoshikazu Yoshida, an organic fluorescent substance indicated to the 99th page - 122 pages of Toshikazu Ota collaboration "fluorescence -theory, measurement, and application -" (Nankodo), It is mentioned as the example of representation by a fluorescent brightener written in the 251st page - 270 pages of the writings, and fluorochrome further written in the 274th page - 287 pages of the writings, and preferably especially, A condensed ring type aromatic-hydrocarbon-rings compound represented by triphenylene, perylene, etc., A line conjugate polynuclear hydrocarbon compound represented by p-terphenyl, quarter phenyl, etc., An acridine, quinoline, carbazole, carbarsone, a fluorene, KISAN thione, A condensed ring type aromatic heterocyclic compound, a thiazole, oxazol, oxadiazole

which are represented by alloxazine, acridone, a flavone, a coumarin, naphthoimidazole, benzooxazol, dibenzo phenazine, etc., An aromatic heterocyclic compound represented by thiadiazole, triazole, etc., Amino KURORОMA laic imide, methylamino SHITORAKONIKKU methylimide, A conjugated system aliphatic compound represented by decapentaene carboxylic acid, decapentaene dicarboxylic acid, etc., The acridine orange NO, methylene blue, fluoro SEIN, eosine, A fluorochrome compound, oxa carbocyanine which are represented by a rhodamine, BENSO flavin, etc., Carbocyanine, thia carbocyanine, and 2 -(anilino polyethylene nil)- Sensitizing dye compounds, such as benzothiazole, A natural-coloring-matter compound represented by porphyrin, chlorophyll, riboflavin, etc., Diaminostilbene, JISUCHIRIRU benzene, benzidine, diaminocarbazole, Triazole, imidazole, a thiazole, oxazol, imidazolone, Dihydropyridine, a coumarin, carbo styryl, diamino dibenzo thiopheneoxide, fluorescent brightener of a diaminofluorene, oxa cyanine, a friend nonaphthalimide, pyrazoline, and an oxadiazole system etc. — it is mentioned, and these may have a substituent and may form a condensed ring further.

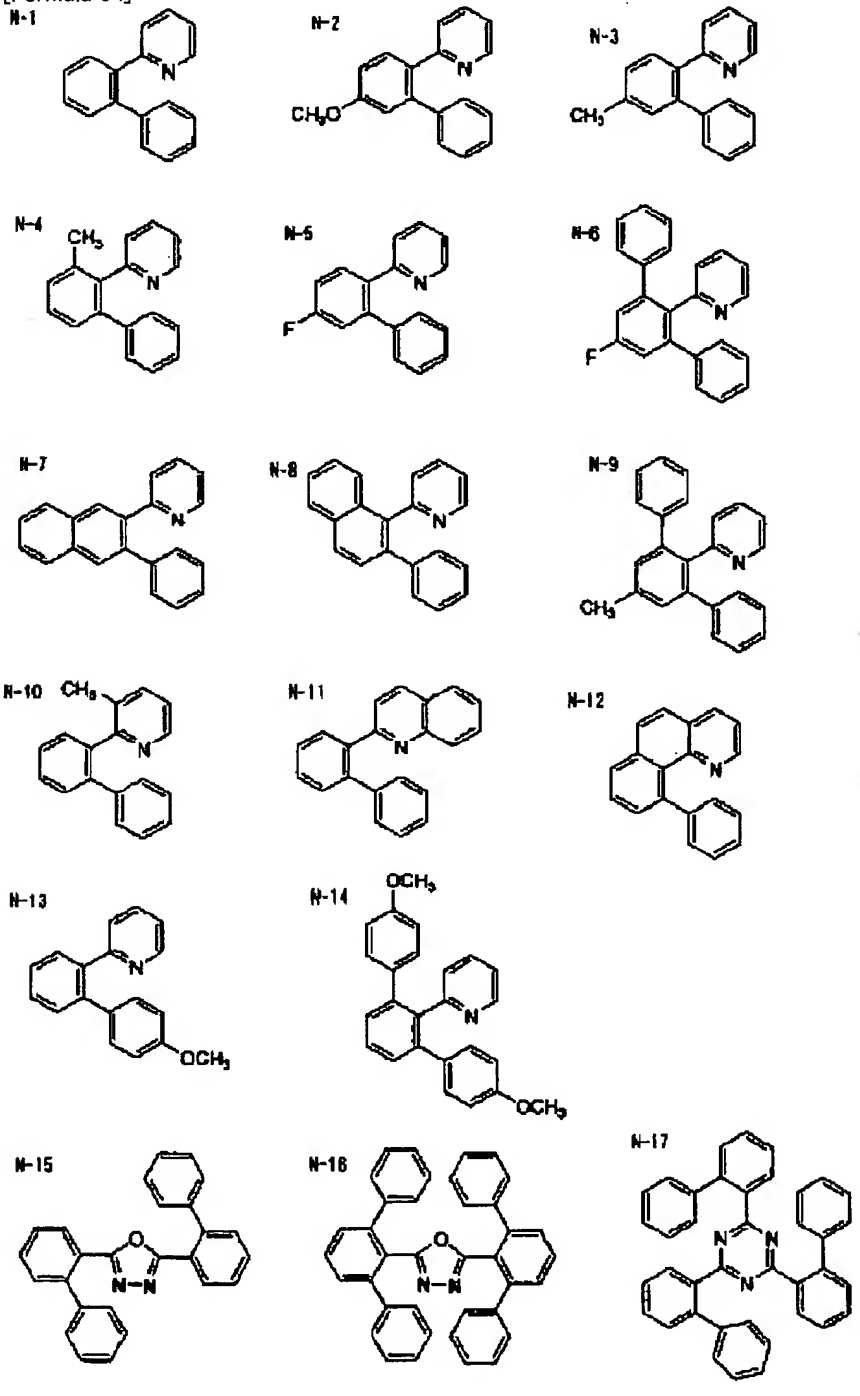
[0072]In a general formula (G1), although a fluorine atom, a chlorine atom, a bromine atom, iodine atoms, and an astatine atom are mentioned as a halogen atom expressed with X_{91}, things desirable in this are a bromine atom and iodine atoms.

[0073]Electroluminescence material may serve both as hole-injection material and electron injection material which are mentioned later in this invention. That is, it may have a hole injection and electron injection capability. Electroluminescence material may use together doping materials (it is also called a dopant and a guest) which make this material a host if needed.

[0074]Although an example of electroluminescence material of this invention is given to below, this invention is not limited to them.

[0075]

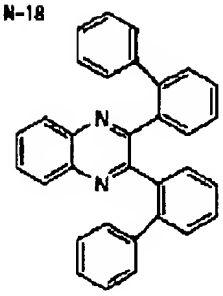
[Formula 34]



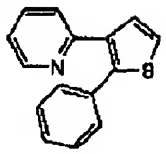
[0076]

[Formula 35]

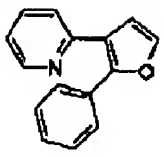
N-18



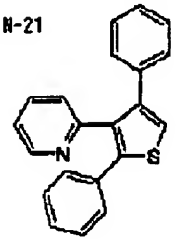
N-19



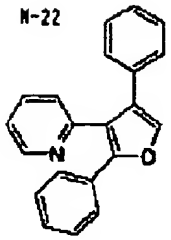
N-20



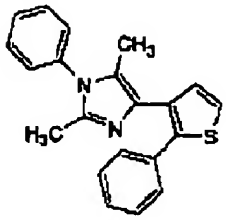
N-21



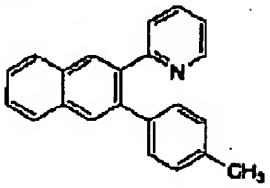
N-22



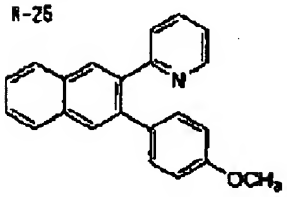
N-23



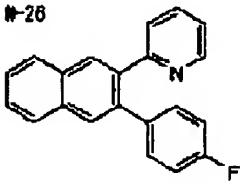
N-24



N-25



N-26



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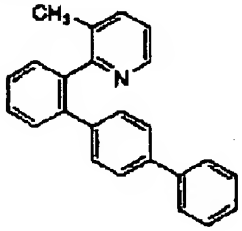

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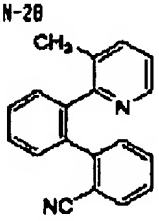
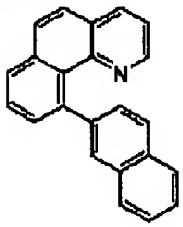


N-29



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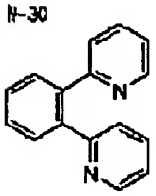
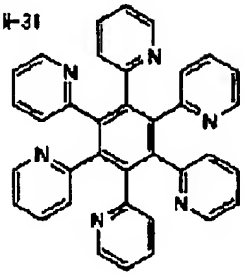
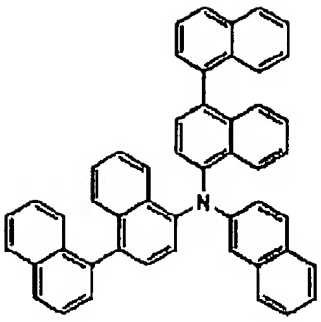


N-31



[0077]
[Formula 36]

A-1



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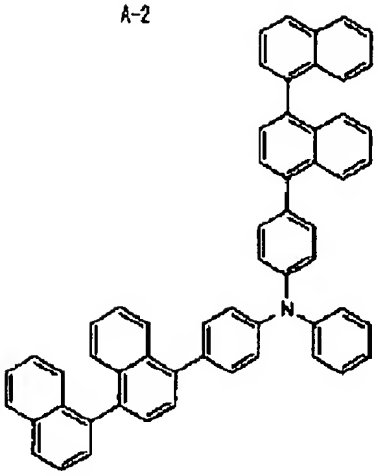
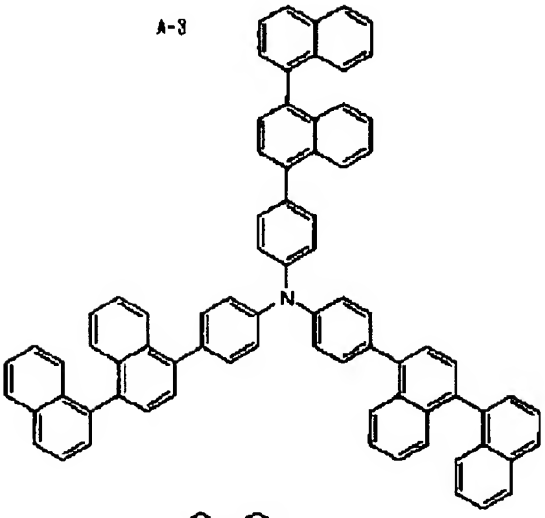


A-3



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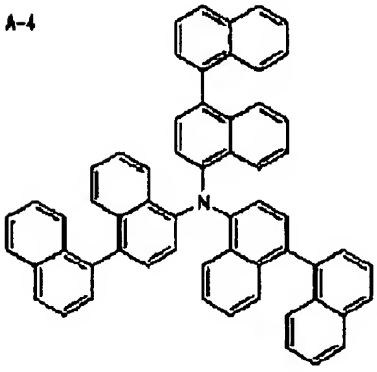

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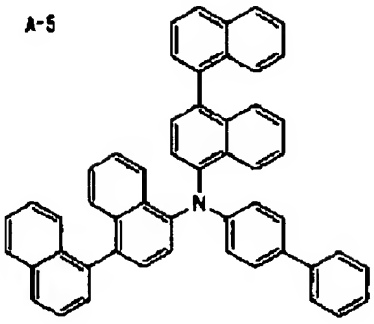
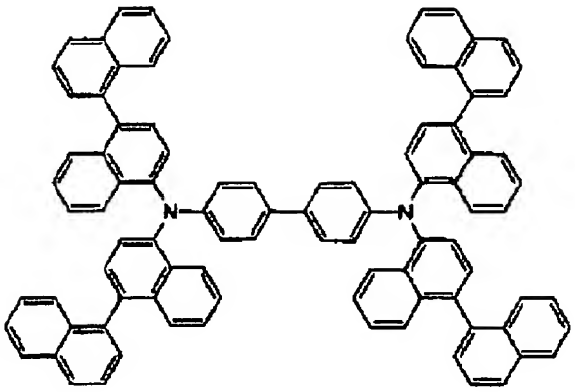
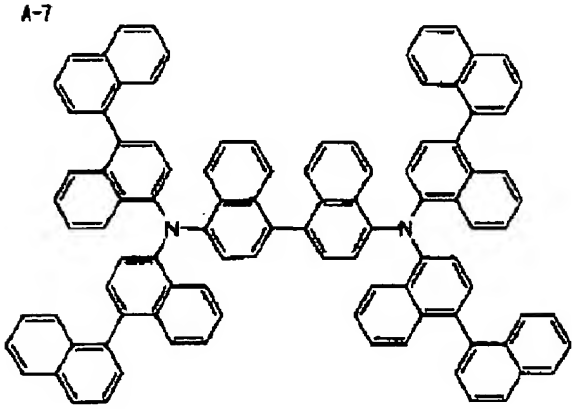


[0078]
[Formula 37]

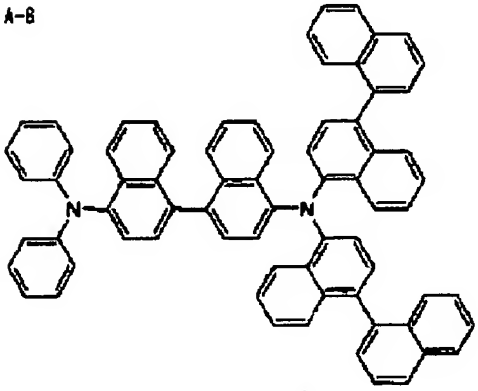
A-6



A-7

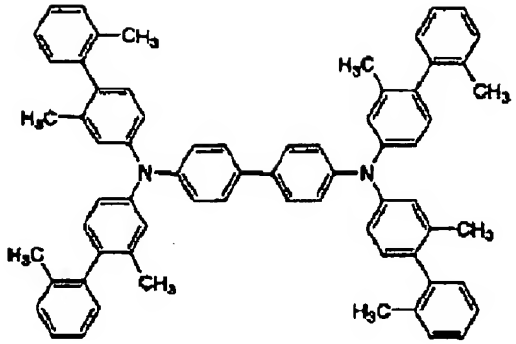


A-8

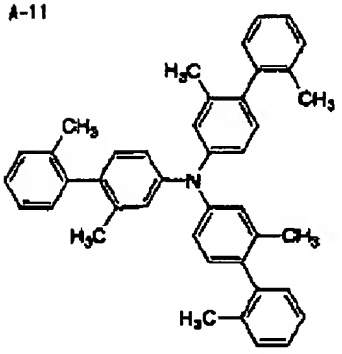


[0079]
[Formula 38]

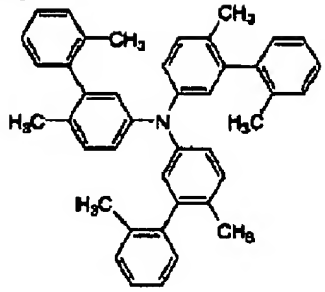
A-10



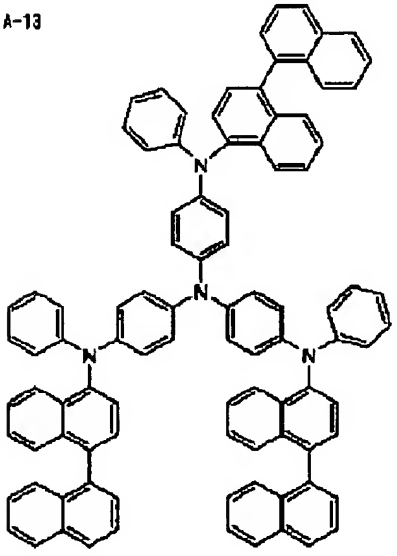
A-11



A-12

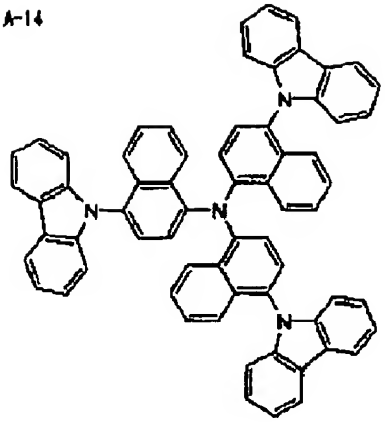


A-13

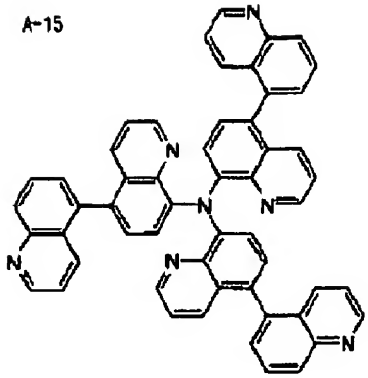


[0080]
[Formula 39]

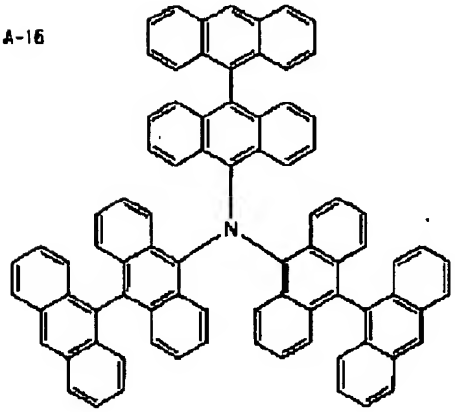
A-14



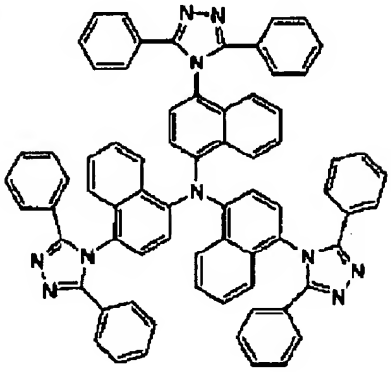
A-15



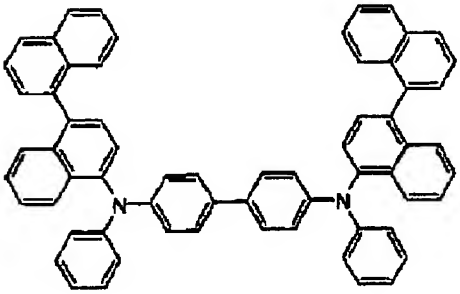
A-16



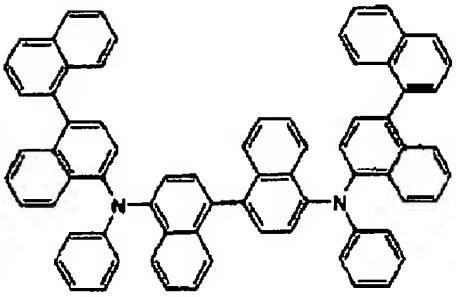
A-17



A-18

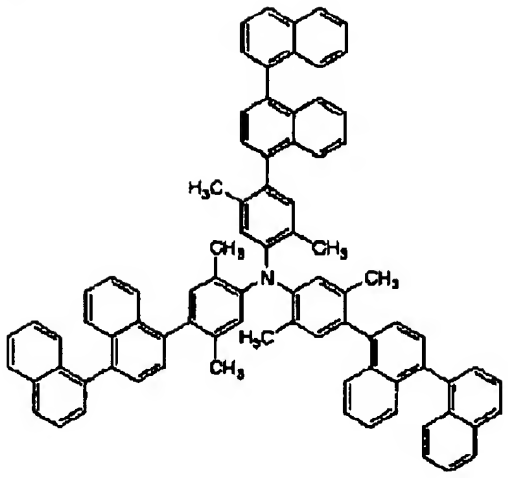


A-19

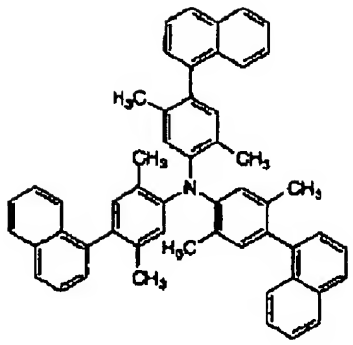


[0081]
[Formula 40]

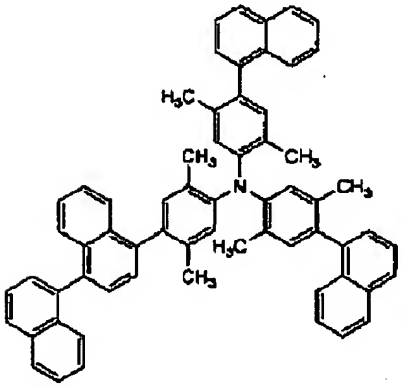
A 20



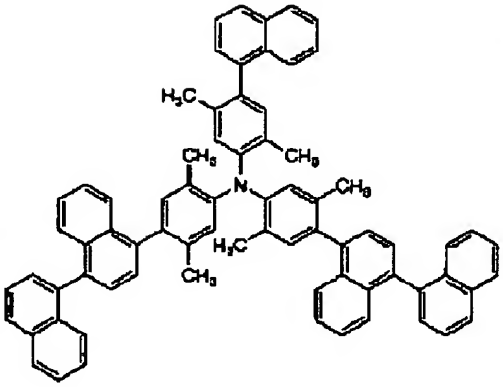
A-21



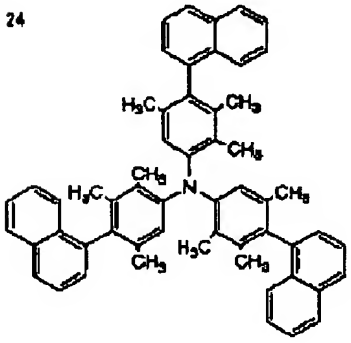
A-22



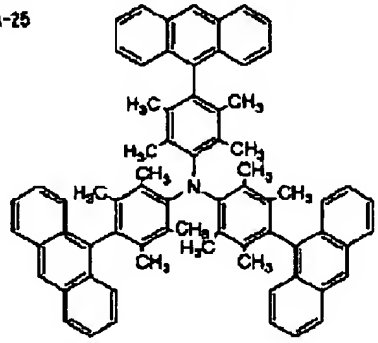
A 23



A 24

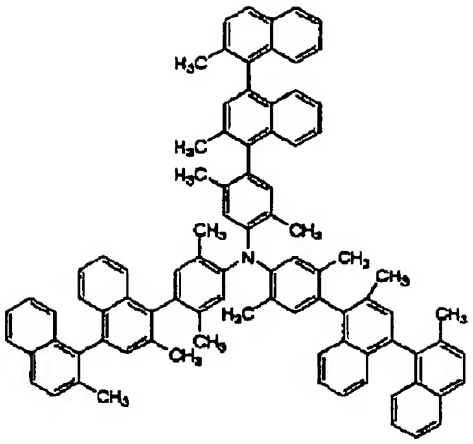


A-25

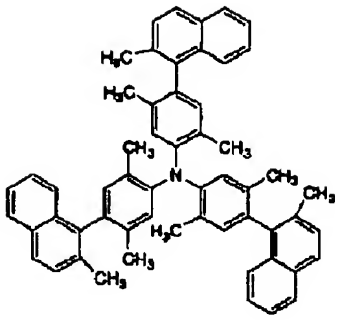


[0082]
[Formula 41]

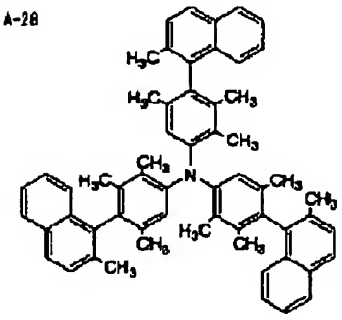
A-26



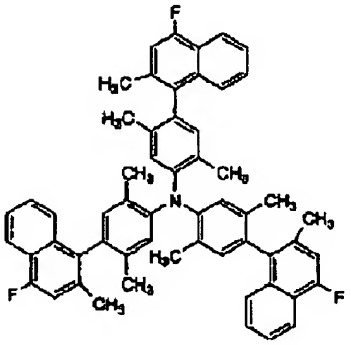
A-27



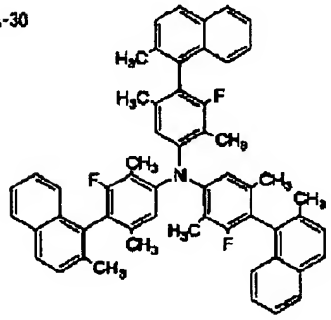
A-28



A-29

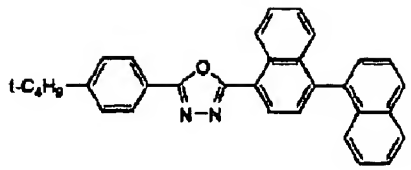


A-30



[0083]
[Formula 42]

B-1



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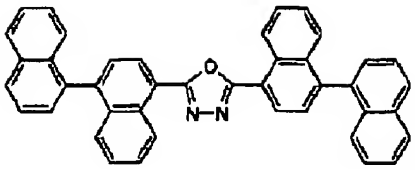
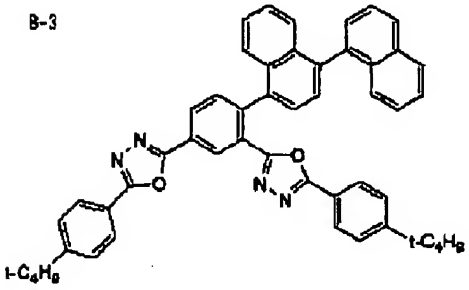
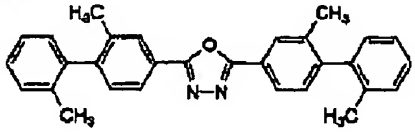


B-3



B-4



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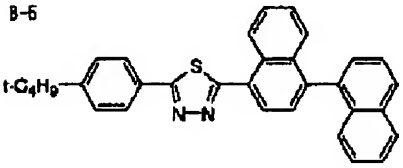
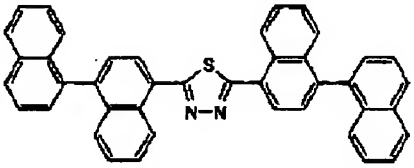
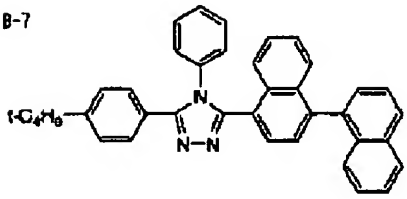


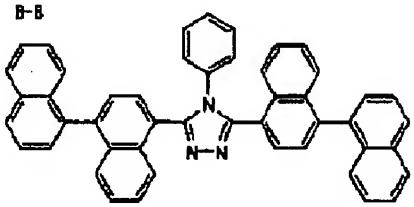
B-6



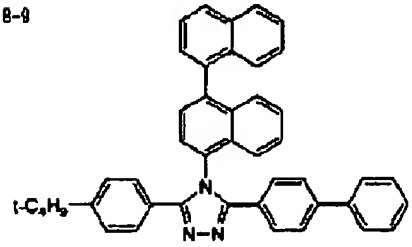
B-7



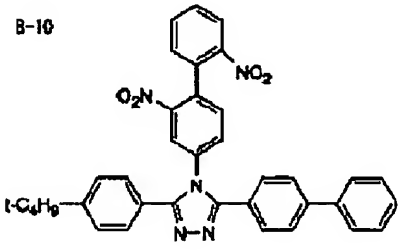
B-8



B-9

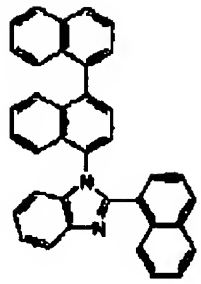


B-10

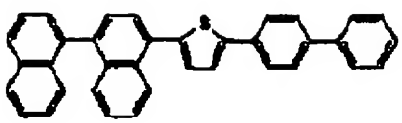


[0084]
[Formula 43]

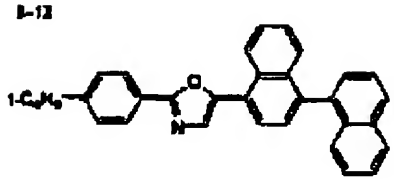
B-11



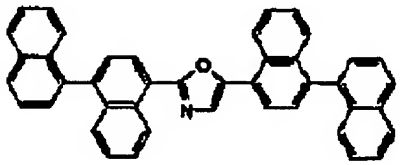
B-12



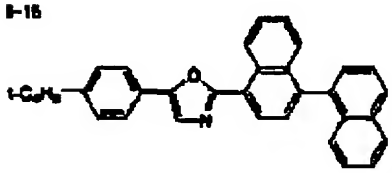
B-13



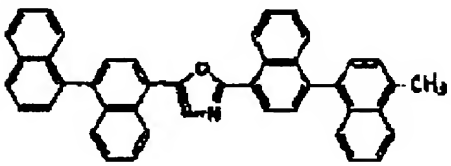
B-14



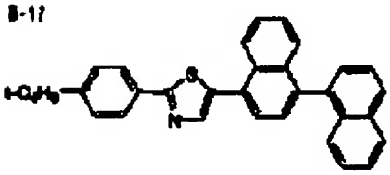
B-15



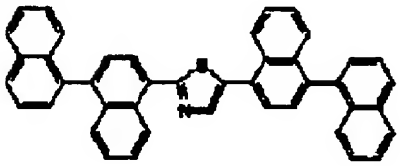
B-16



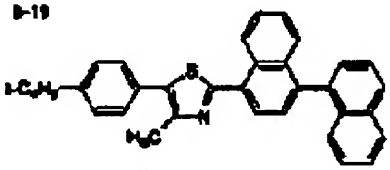
B-17



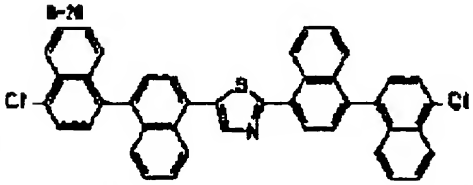
B-18



B-19

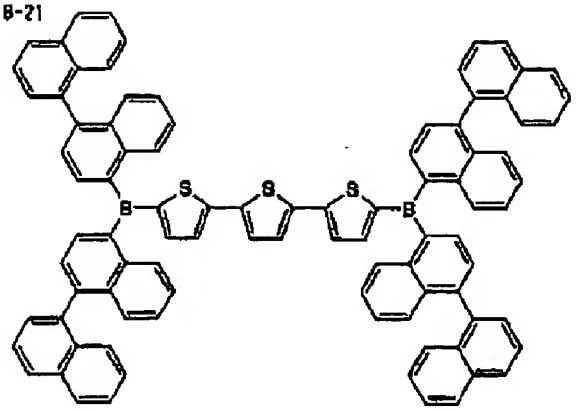


B-20

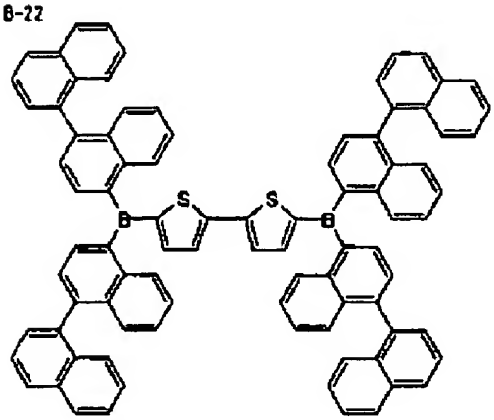


[0085]
[Formula 44]

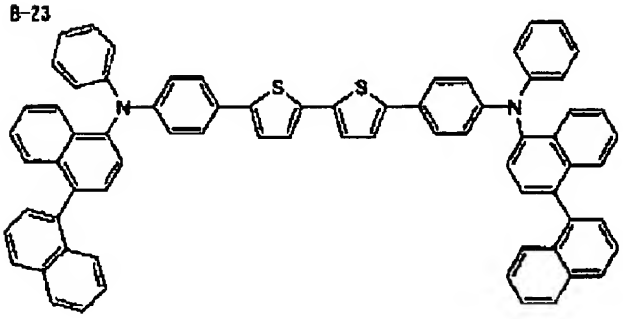
B-21



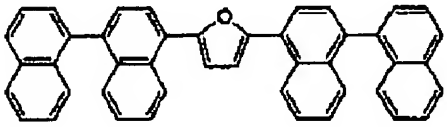
B-22



B-23

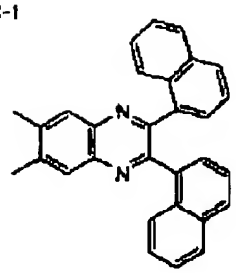


B-24

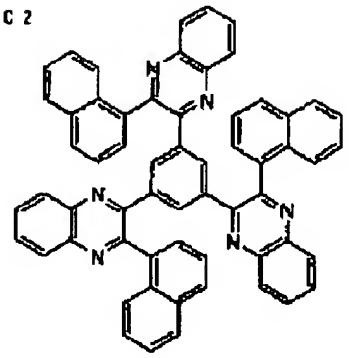


[0086]
[Formula 45]

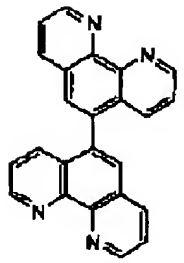
C-1



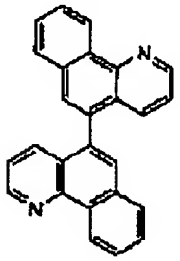
C-2



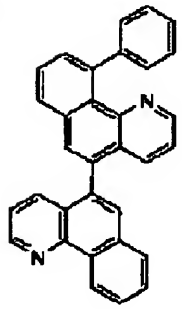
C-3



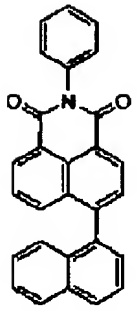
C-4



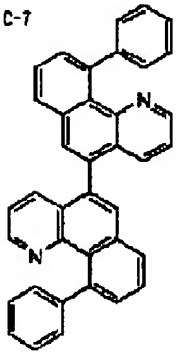
C-5



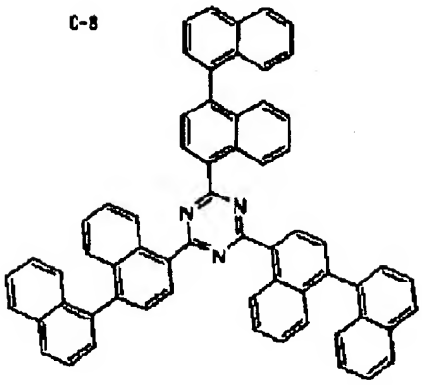
C-6



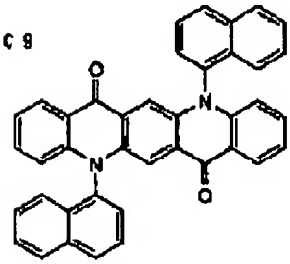
C-7



C-8

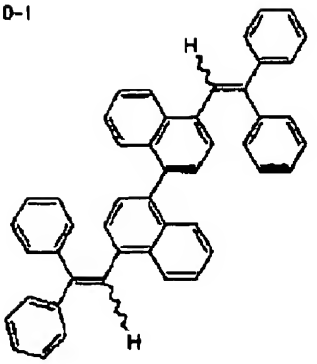


C-9

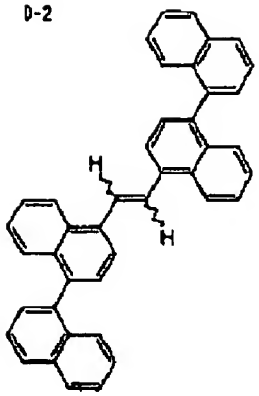


[0087]
[Formula 46]

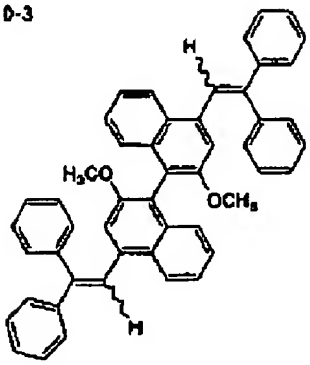
D-1



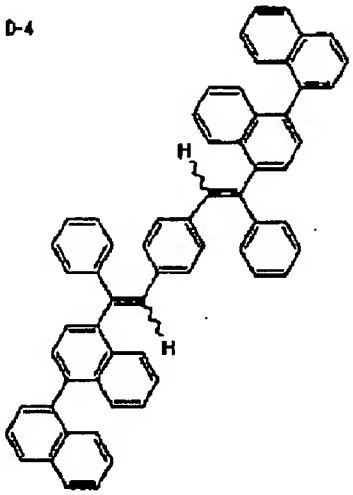
D-2



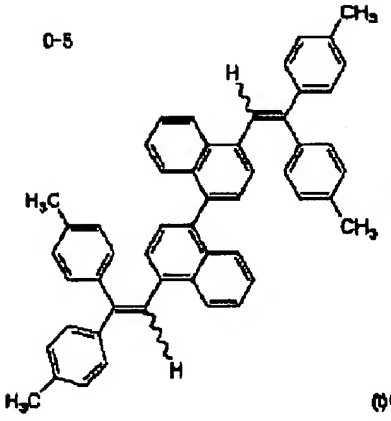
D-3



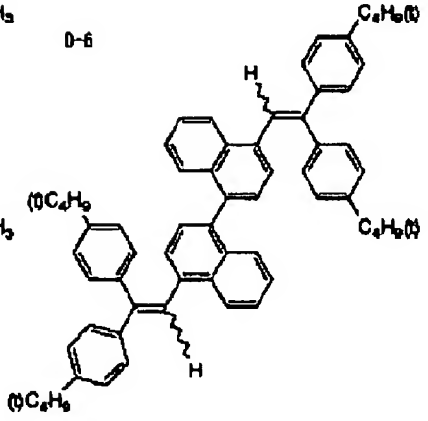
D-4



D-5

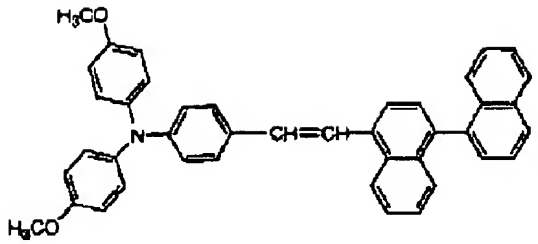


D-6

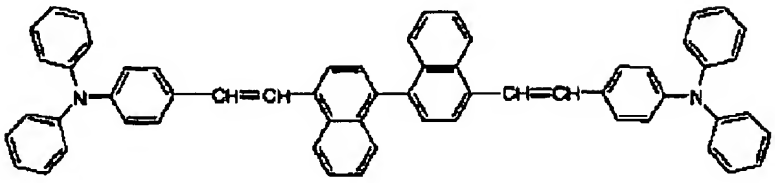


[0088]
[Formula 47]

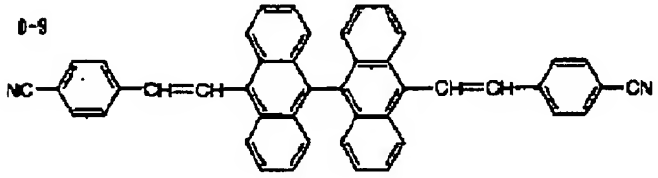
D-7



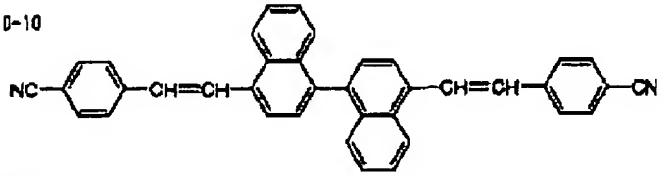
D-8



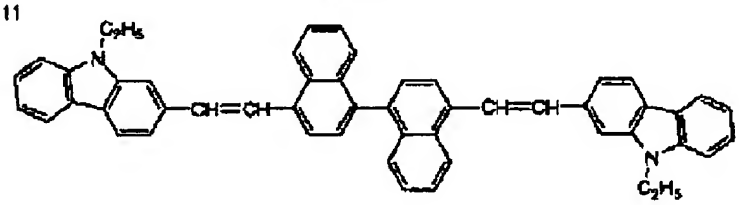
D-9



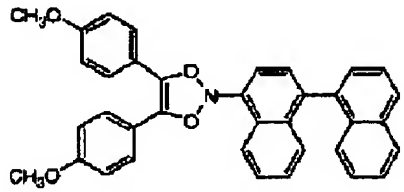
D-10



D-11

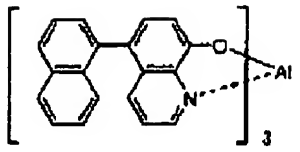


D-12

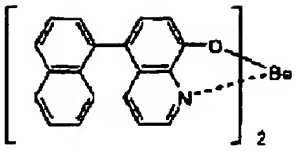


[0089]
[Formula 48]

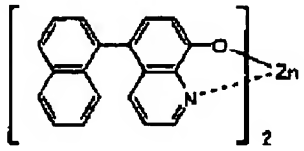
E-1



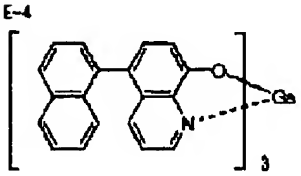
E-2



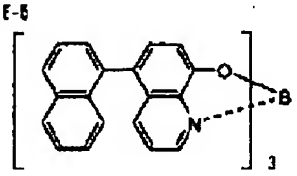
E-3



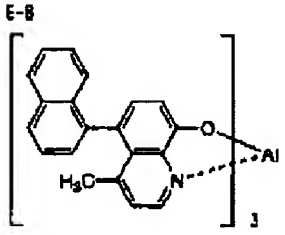
E-4



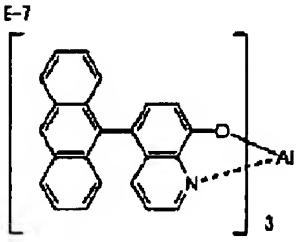
E-5



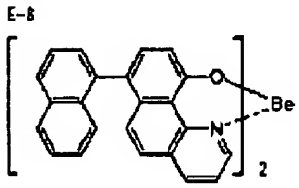
E-6



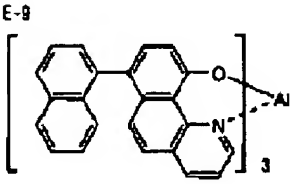
E-7



E-8



E-9



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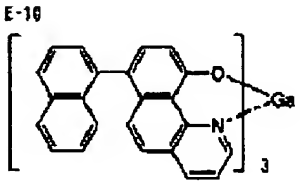
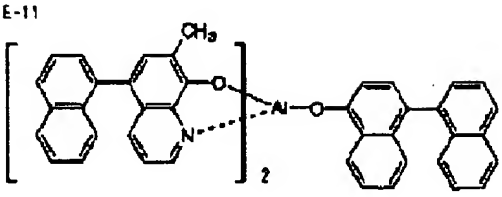
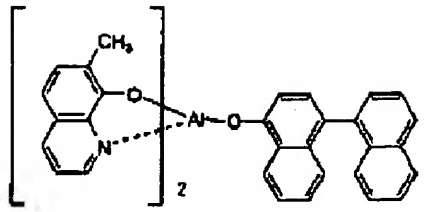


E-11

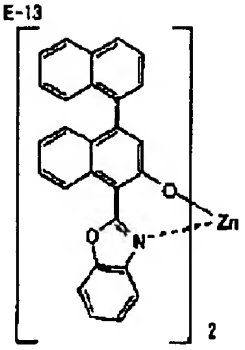


[0090]
[Formula 49]

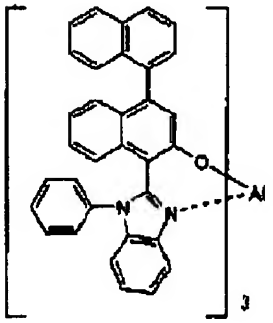
E-12



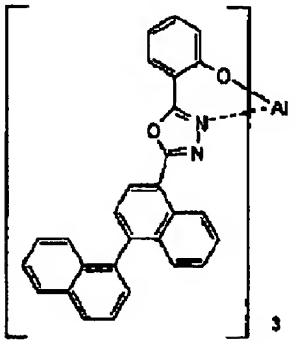
E-13



E-14



E-15



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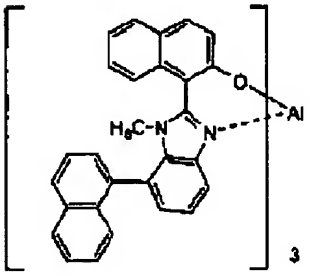
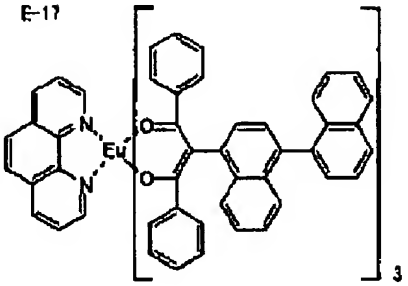
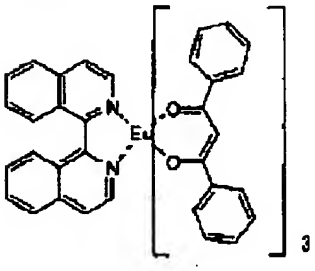


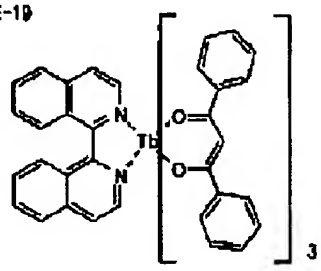
E-17



E-18

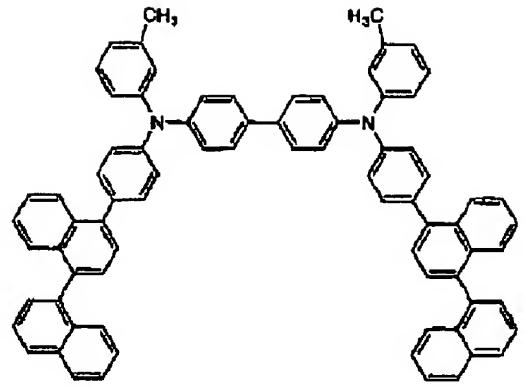


E-19



[0091]
[Formula 50]

F-1



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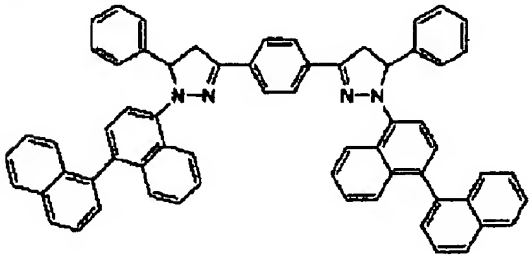
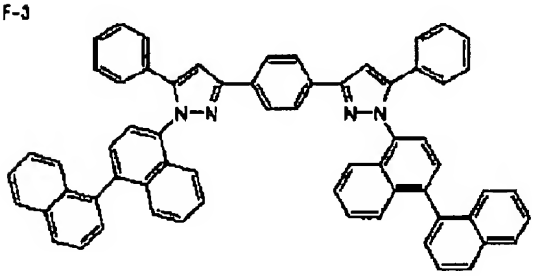
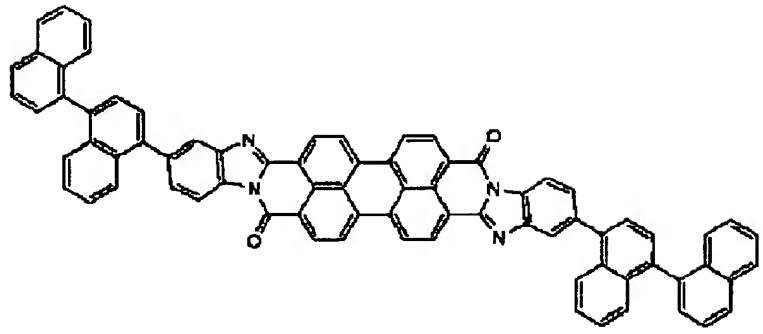


F-3

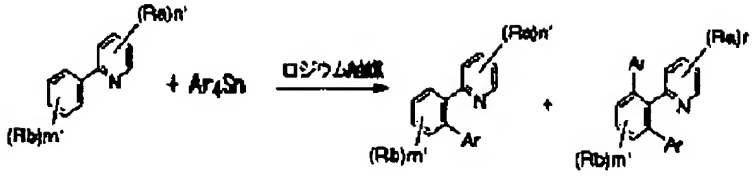


F-4

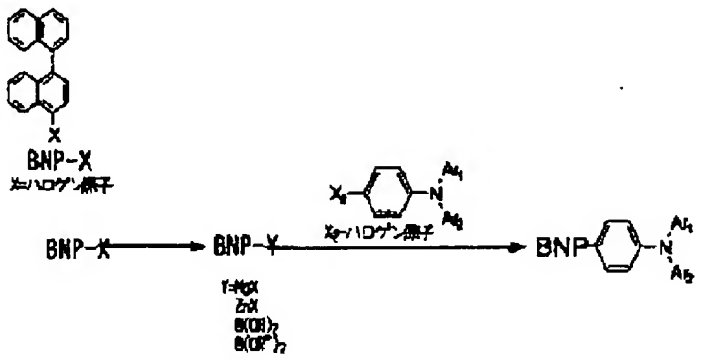


[0092]
[Formula 51]

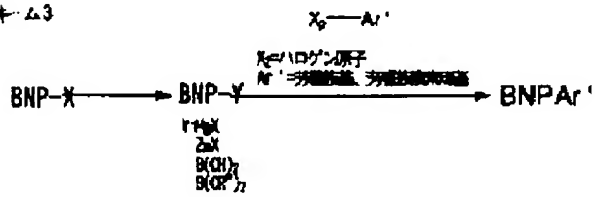
スキーム1



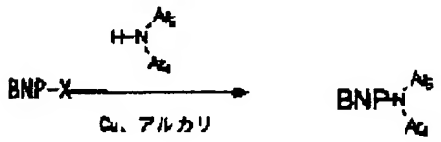
スキーム2



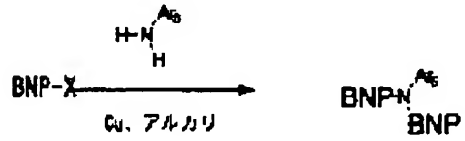
スキーム3



スキーム4

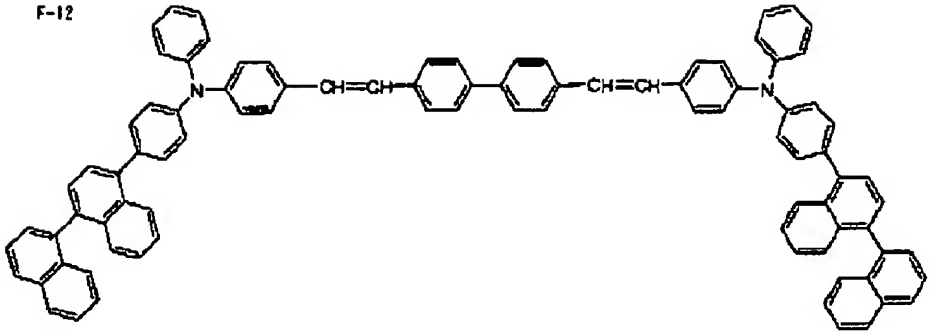


スキーム5

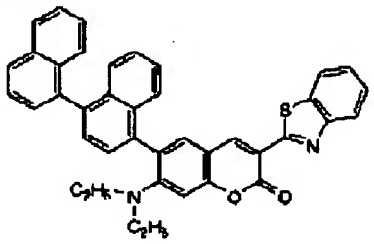


[0093]
[Formula 52]

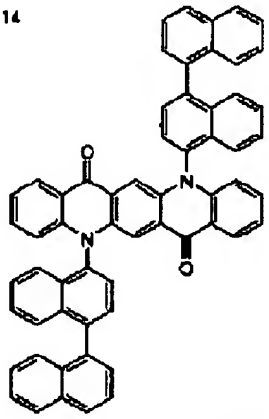
F-12



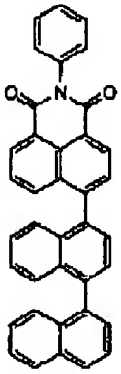
F-13



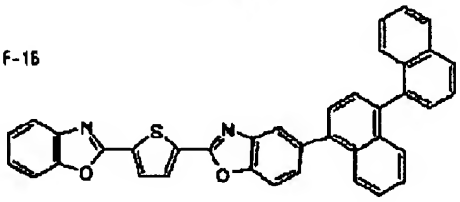
F 14



F 15



F-16



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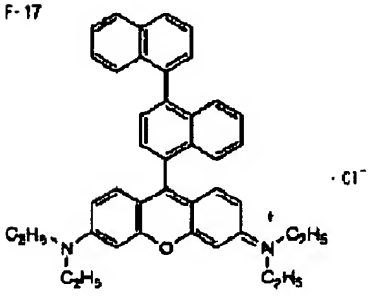
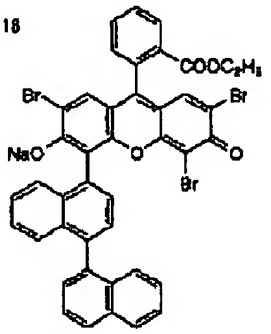
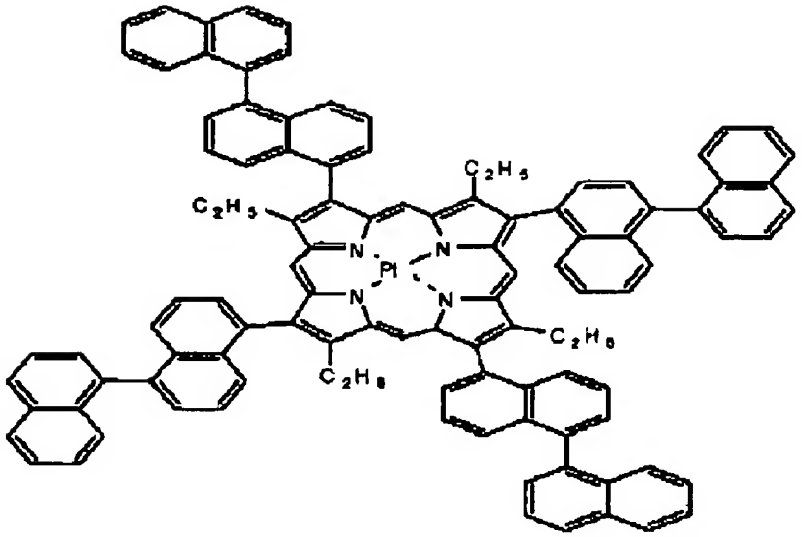


F 18

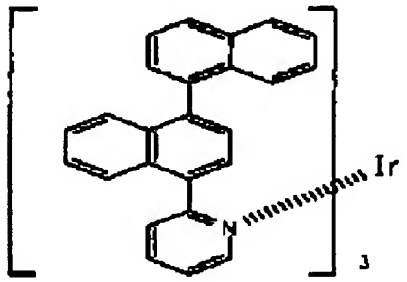


[0094]
[Formula 53]

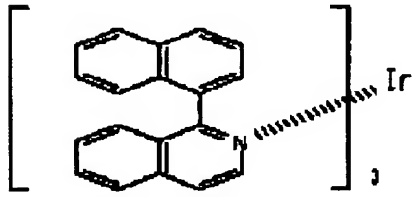
F 19



F-20



F-21



[0095]With next, the electroluminescent element as used in the field of this invention. The element which has a counterelectrode of a couple on both sides of the layer which contains the inorganic system fluorescent substance or rare earth complex system fluorescent substance which absorbs the light emitted from said lower electroluminescence material and this electroluminescence material, and shows a fluorescence on a base, and contains electroluminescence material is said. Here, it contains in layer with another electroluminescence material, inorganic system fluorescent substance, or rare earth complex system fluorescent substance, and does not exist in the same layer.

[0096]In a lower statement, especially, as long as there is no specification, electroluminescence material exists a layer containing a luminous layer in which layer of a luminous layer, a hole injection layer, and an electronic injection layer, and an inorganic system fluorescent substance and/or a rare earth complex system fluorescent substance exist in a color conversion layer.

[0097]An electroluminescent element in this invention may make an electronic injection layer and a hole injection layer intervene if needed.

[0098]A base preferably used for an electroluminescent element of this invention does not have limitation in particular in kinds, such as glass and a plastic, and if transparent, there will be no restriction in particular. As a base preferably used for an electroluminescent element of this invention, glass, quartz, and a light transmittance state plastic film can be mentioned.

[0099]As a light transmittance state plastic film, for example Polyethylene terephthalate (PET), Polyethylenenaphthalate (PEN), polyether sulphone (PES), A film etc. which consist of polyether imide, a polyether ether ketone, a polyphenylene sulfide, polyarylate, polyimide, polycarbonate (PC), cellulose triacetate (TAC), cellulose acetate propionate (CAP), etc. are mentioned.

[0100]Although it is preferred to use electroluminescence material of this invention for a luminous layer as for an electroluminescent element of this invention, it may be used together with a publicly known luminescent material. Specifically, they are "an organic EL device and its industrialization front line". November 30, 1998 N Tea S issue. (it may be hereafter called the literature A.) — a low molecule system luminescent material indicated in Chapter 3 per piece [the] (the 35th page – the 51st page). Coloring matter dope material indicated in Chapter 4 per piece [the] of the literature A (the 55th page – the 79th page), polymers system material indicated in Chapter 5 per piece [the] of the literature A (the 81st page – the 100th page, the 178th page – the 189th page, 192 pages – the 212nd page of ****), etc. can be mentioned. A compound which has gone up to a cited document in these articles can be used similarly.

[0101]An electroluminescent element contains a monolayer or two or more layers in inter-electrode [two], and is usually constituted, As this composition layer, a hole injection layer (or it is also called an electric charge pouring layer, a hole pouring layer, a charge transport layer, and a hole transporting bed), an electronic injection layer (or it is also called an electron transport layer), etc. other than said luminous layer are mentioned.
[0102]The above, a hole injection layer, and an electronic injection layer may take a laminated structure further if needed, for example, may take lamination like the anode / the 1st hole injection layer / the 2nd hole injection layer (electron hole transporting bed) / luminous layer / the 2nd electronic injection layer (electron transport layer) / the 1st electronic injection layer / negative pole.
[0103]An example of lamination of an electroluminescent element in this invention is shown below (however, although a statement about two or more hole injection layers and/or electronic injection layers is omitted like the above, naturally they may form a laminated structure which becomes in piles about two or more compounds.).
A substrate / color conversion layer / substrate / anode / luminous layer / negative pole. (2) A substrate / color conversion layer / substrate / anode / hole injection layer / luminous layer / negative pole. (3) A substrate / color conversion layer / substrate / anode / luminous layer / electronic injection layer / negative pole. (4) A substrate / color conversion layer / substrate / anode / hole injection layer / luminous layer / electronic injection layer / negative pole (5) board / anode / luminous layer / negative pole / color conversion layer / substrate (6) board / anode / hole injection layer / luminous layer / negative pole / color conversion layer / substrate (7) board / anode / luminous layer / electronic injection layer / negative pole / color conversion layer / substrate. (8) a substrate / anode / hole injection layer / luminous layer / electronic injection layer / negative pole / color conversion layer / substrate — here, a substrate which touches a substrate which touches a color conversion layer, and the anode may be the same, or it may differ, and the outside of each element may be further covered with a substrate.
[0104]A buffer layer (electrode interface layer) may be made to exist between the anode, a luminous layer, or a hole injection layer and between the negative pole, a luminous layer, or an electronic injection layer.
[0105]A buffer layer is a layer provided between an electrode and an organic layer for a driver voltage fall or improvement in luminous efficiency, it is indicated in detail in piece [2nd] chapter 2 of the literature A "electrode material" (the 123rd page - the 166th page), and there are an anode buffer layer and a cathode buffer layer.
[0106]A phthalocyanine buffer layer represented by copper phthalocyanine as an anode buffer layer, A polymers buffer layer using conductive polymers represented by vanadium oxide, such as an oxide buffer layer, an amorphous carbon buffer layer, poly aniline (EMERARU DIN), and a polythiophene, etc. are mentioned.
[0107]A metal buffer layer represented by strontium, aluminum, etc. as a cathode buffer layer, An alkali-metal-compound buffer layer represented by lithium fluoride, an alkaline earth metal compound buffer layer represented by magnesium fluoride, an oxide buffer layer represented by aluminum oxide, etc. are mentioned.
[0108]As for the above-mentioned buffer layer, it is desirable that it is a very thin film, and although based also on a raw material, the thickness has the preferred range of 0.1-100 nm.
[0109]Although it can form by thin-film-izing, for example by publicly known methods, such as vacuum deposition, a spin coat method, the cast method, and the LB method, as a method of forming a luminous layer, a hole injection layer, an electronic injection layer, or a buffer layer, it is preferred that it is especially a molecule deposited film. Here, molecule deposited films are a thin film deposited and formed from a vapor phase state of this compound, and a film solidified and formed from a molten state or a liquid phase state of this compound. Usually, this molecule deposited film is distinguishable according to a thin film (molecule built up film) formed by the LB method, and a difference of condensation structure and higher order structure and a functional difference resulting from it.
[0110]After this luminous layer melts the above-mentioned luminescent material in a solvent and considers it as a solution with binding materials, such as resin, as indicated to JP,57-51781,A, it can thin-film-ize this with a spin coat method etc., and can form it. Thus, although there is no restriction in particular about thickness of a formed luminous layer and it can choose suitably according to a situation, it is preferred to be used in 5 nm - 5 micrometers.
[0111]What uses large (not less than 4 eV) metal, an alloy, electrical conductivity compounds, and these mixtures of a work function as electrode material as the anode in this electroluminescent element is used preferably. As an example of such electrode material, conductive transparent materials, such as metal, such as Au, CuI, indiumtinoxide (ITO), SnO_2, ZnO, and zinc dope indium oxide (IZO), are mentioned. This anode such electrode material by methods, such as vacuum evaporation and sputtering. When a thin film may be made to form, and a pattern of desired shape may be formed with the photolithographic method or you seldom need pattern accuracy, it may form a pattern via a mask of desired shape at the time of vacuum evaporation and sputtering of (about not less than 100 micrometers) and the above-mentioned electrode material.
[0112]When taking out luminescence from this anode, it is desirable to make transmissivity larger than 10%, and below 10 ^{3}omega/** of sheet resistance as the anode are preferred. Although thickness of the anode can be suitably chosen with material, it is preferred to use at 10 nm - about 1 micrometer, and it is still more preferred that it is 10-200 nm.
[0113]What, on the other hand, uses small (less than 4 eV) metal (electron injectional metal may be called), an alloy, electrical conductivity compounds, and these mixtures of a work function as electrode material as the negative pole is used. As an example of such electrode material, potassium, sodium, a sodium potassium alloy, Magnesium, lithium, magnesium / copper mixture, magnesium / silver mixture, Magnesium / aluminum mixture, magnesium / indium mixture, aluminum / aluminum oxide (aluminum$_2O_3$) mixture, indium, lithium / aluminum mixture, a rare earth metal, etc. are mentioned.
[0114]From a durable point of as opposed to electron injection nature, oxidation, etc. in inside of these to magnesium / silver mixture. Like magnesium / aluminum mixture, magnesium / indium mixture, aluminum / aluminum oxide (aluminum$_2O_3$) mixture, and lithium / aluminum mixture, a mixture of electron injectional metal and metal with a bigger value of a work function than this is preferred.
[0115]However, in using it, painting the above cathode buffer layers on a cathode surface. The negative pole by using fluoride of an alkaline metal or alkaline-earth metals for a cathode buffer layer (an "electronic injection layer" is called in this patent specification) as restriction of a work function is canceled, for example, it is indicated to JP,11-224783,A ITO and SnO_2, As a big substance of a work function used can also be used as the usual anodes, such as In_2O_3 and ZnO:aluminum, and it is indicated to the 15th line - the 28th page [145th] line of the literature A, By using lithium fluoride (0.5-1 micrometer of

thickness) as a cathode buffer layer, It is known that aluminum can use it as a cathode material etc., and an element defined by the periodic tables, such as said metallic oxide, silver besides aluminum, copper, and platina ** gold, as "metal" can be used as a cathode material in a case of using such a cathode buffer layer.
[0116]This negative pole can produce such electrode material by making a thin film form by methods, such as vacuum evaporation and sputtering. It is also possible to create with plating which is indicated to JP,11-8074,A.
[0117]Below 10 ^{3}omega/** of sheet resistance as the negative pole are preferred. As for thickness of the negative pole, it is preferred that they are 10 nm - 100 micrometers, and it is still more preferred that it is 50-2000 nm.
[0118]In order to make luminescence penetrate, luminous efficiency whose electrode located between a luminous layer of an electroluminescent element and a color conversion layer is transparent or translucent improves, and it is preferred.
[0119]That an electrode is transparent or that it is translucent mean here that visible light transmittance at 400 nm - 700 nm is not less than 20%, and it is preferred that it is not less than 50%. a hole injection layer formed if needed in this invention having the function to transmit an electron hole poured in from the anode to a luminous layer, and making this hole injection layer intervene between the anode and a luminous layer — a lower electric field — many electron holes — a luminous layer — notes ON — last ** An interface in a luminous layer accumulates with a barrier of an electron poured into a luminous layer from the negative pole or an electronic injection layer, and an electron which exists in an interface of a luminous layer and a hole injection layer, and it becomes the element which was excellent in luminescent ability — luminous efficiency improves.
[0120]About material (henceforth hole-injection material) used for this hole injection layer, if it has the aforementioned function, there will be no restriction in particular, and arbitrary things can be conventionally chosen and used out of a publicly known thing.
[0121]The above-mentioned hole-injection material may have barrier either electronic pouring of an electron hole or nature, and may be any of an organic matter and an inorganic substance.
[0122]Into an organic hole-injection material, for example JP,63-295695,A, JP,2-191694,A, JP,3-792,A, JP,5-234681,A, Various organic compounds indicated in JP,5-239455,A, JP,5-299174,A, JP,7-126225,A, JP,7-126226,A, JP,8-100172,A, EP 0650955ANo. 1 gazette, etc. can be used. For example, they are a phthalocyanine derivative, a tetra aryl BENJISHIN compound, the third class of aromatic amine, a hydrazone derivative, a carbazole derivative, a triazole derivative, an imidazole derivative, an oxadiazole derivative that has an amino group, a polythiophene, etc. These compounds may use two or more sorts together, and when using together, they are made into a different layer, and they should just laminate or mix them.
[0123]When laminating and using a hole injection layer, desirable combination can be chosen and used out of the above-mentioned compound (when using a function of a hole injection and electron hole transportation properly). At this time, it is preferred to laminate in order of a layer of a small compound of ionization potential from the anode sides (ITO etc.). It is preferred to use for the anode surface a filmy (film production nature) good compound (for example, a starburst type compound etc. which are indicated to JP,4-308688,A etc. are the example of representation).
[0124]As an example of representation of the above-mentioned aromatic tertiary-amine compound and a styryl amine compound, it is a N,N,N',N'-tetraphenyl-4,4'-diaminophenyl and N,N'-diphenyl-N,N'-screw (3-methylphenyl). - [1,1'-biphenyl] -4,4'-diamine (TPD), 2,2-bis(4-di-p-tolylamino phenyl)propane, 1,1-bis(4-di-p-tolylamino phenyl)cyclohexane, N,N,N',N'-tetra-p-tolyl 4,4'-diaminobiphenyl, 1,1-bis(4-di-p-tolylamino phenyl)-4-phenylcyclohexane, A bis(4-dimethylamino 2-methylphenyl)phenylmethane, A bis(4-di-p-tolylamino phenyl)phenylmethane, N,N'-diphenyl-N,N'-JI (4-methoxypheny)-4,4'-diaminobiphenyl, N,N,N',N'-tetraphenyl-4,4'-diaminodiphenyl ether, 4,4'-bis(diphenylamino)KUODORI phenyl, N,N,N-Tori (p-tolyl) amine, 4-(di-p-tolylamino)-4' - [4-(di-p-tolylamino) styryl] A stilbene, 4-N,N-diphenylamino (2-diphenylvinyl) benzene, 3-methoxy-4'-N,N-diphenylamino still benzene, N-phenylcarbazole, and a thing that has further two fused aromatic rings written in a U.S. Pat. No. 5061569 specification in intramolecular, for example, a 4,4'-screw [N-(1-naphthyl)-N-phenylamino] 4, 4', 4"-tris by which biphenyl (NPD) and a triphenylamine unit indicated to JP,4-308688,A were connected with 3 starburst type [N-(3-methylphenyl)-N-phenylamino] A triphenylamine (MTDATA) etc. are mentioned.
[0125]P type-Si, p type-SiC, etc. can be used as an inorganic hole-injection material.
[0126]This hole injection layer can form the above-mentioned hole-injection material, for example by thin-film-izing by publicly known methods, such as a vacuum deposition method, a spin coat method, the cast method, and the LB method. Although there is no restriction in particular about thickness of a hole injection layer, it is preferred that they are 5 nm - about 5 micrometers.
[0127]The electronic injection layer used if needed should just have the function to transmit an electron poured in from the negative pole to a luminous layer, and as the material, conventionally, out of a publicly known compound, it can choose arbitrary things and it can be used for it.
[0128]An electronic injection layer is formed when an electron injection transportation function of a compound used for a luminous layer is not so high, and it has a function which bars a function which makes pouring of an electron from the negative pole easy, a function to convey an electron, and an electron hole. An electron injection transporting bed may be separately provided in a layer with a pouring function, and a layer with a transportation function.
[0129]As an example of material (henceforth electron injection material) used for this electronic injection layer, A nitration fluorene derivative, a diphenyl quinone derivative, a thiopyrandioxide derivative, Heterocyclic tetracarboxylic anhydrides, such as naphthalene perylene, a carbodiimide, a FUREORENIRIDEN methane derivative, anthra quinodimethane and the Antron derivative, an oxadiazole derivative, etc. are mentioned. A series of electron transport nature compounds indicated to JP,59-194393,A can be used also as an electron injection material, although indicated in this gazette as a material which forms a luminous layer. A thiadiazole derivative which replaced an oxygen atom of an oxadiazole ring by a sulfur atom in the above-mentioned oxadiazole derivative, A triazole derivative replaced by arylamino group and an alkylamino group and a quinoxaline derivative which has the quinoxaline ring known as an electron withdrawing group can also be used as an electron injection material.
[0130]A metal complex (Alq), for example, tris(eight quinolinol) aluminum, of an eight-quinolinol derivative, Tris(5,7-dichloro-eight quinolinol) aluminum, tris(5,7-dibromo-eight quinolinol) aluminum, Tris(2-methyl-eight quinolinol) aluminum, tris(5-methyl-eight quinolinol) aluminum, Metal complexes in which a central metal of these metal complexes replaced In, Mg, Cu, Ca, Sn, Ga, or Pb, such as bis(eight quinolinol)zinc (Znq), can also be used as an electron injection material. In addition, said literature A ** Editing ** That by which metal complex system material of a statement, metal free metal phthalocyanines, or those ends are replaced [with a chapter of the 38th page - page / 48th] with an alkyl group, a sulfonic group, etc. can also

be preferably used as an electron injection material. Inorganic semiconductors, such as n type-Si and n type-SiC, as well as a hole injection layer can be used as an electron injection material.

[0131]This electronic injection layer can be produced, for example by a thin film-ized method a vacuum deposition method, a spin coat method, the cast method, the LB method, etc. are publicly known, and can form the above-mentioned compound.

[0132]As for thickness as an electronic injection layer, although there is no restriction in particular, it is preferred that they are 5 nm - about 5 micrometers.

[0133]An electronic injection layer may be one layer system containing the above-mentioned electron injection material kind or two sorts or more, or may be a laminated structure which has two or more layers of the same presentation or a different-species presentation.

[0134]Next, an inorganic system fluorescent substance and a rare earth complex system fluorescent substance in this invention are explained.

[0135]In this invention, if light is emitted to a maximum luminous wavelength which absorbs luminescence emitted from said electroluminescence material as an inorganic system fluorescent substance and a rare earth complex system fluorescent substance, and is different from a maximum luminous wavelength of this electroluminescence material, there will be no restriction in particular.

[0136]Here, a different luminous wavelength from a maximum luminous wavelength emitted from electroluminescence material says what not less than 10 nm of maximum luminous wavelengths of an inorganic system fluorescent substance left to a maximum luminous wavelength which electroluminescence material emits.

[0137]As for an inorganic system fluorescent substance or a rare earth complex system fluorescent substance contained in an electroluminescent element of this invention, it is preferred that it is what has the maximum luminescence to a 400-700-nm field by light emitted from electroluminescence material.

[0138]As for an inorganic system fluorescent substance or a rare earth complex system fluorescent substance contained in an electroluminescent element of this invention, it is preferred to contain at least one sort of things which have a maximum luminous wavelength in the not less than 180-nm long wave side to a maximum luminous wavelength emitted from electroluminescence material.

[0139]An electroluminescent element of this invention, At least one sort of an inorganic system fluorescent substance or a rare earth complex system fluorescent substance which has a maximum luminous wavelength in 400-500 nm for the purpose of full-color-izing by light emitted from electroluminescence material, It is preferred to have a color conversion layer which has at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in 501-600 nm, or a rare earth complex system fluorescent substance, and 601-700 nm, or a rare earth complex system fluorescent substance, respectively.

[0140]The color conversion layer can take various gestalten by a use.

[0141]For example, it is not necessary to pattern especially in that case, and what is necessary is just to paint by uniform thickness, although a mixture of three sorts of fluorescent substances, blue light, green emission, and red light, is used to use a white surface state photogen, using a mixture of a fluorescent substance which emits light blue, and a fluorescent substance which emits light in yellow.

[0142]To obtain a multiple-color-ized color conversion filter like a light filter of a liquid crystal display. What is necessary is just to pattern a fluorescent substance in which the luminescent color to need is obtained after stripe shape, dot form, or mosaic shape, and as the patterning method, A manufacturing method of the conventional light filter for liquid crystal displays can apply as it is, and it can specifically create by a pigment dispersion method, print processes, the ink jet method, etc.

[0143]Y_2O_2S which is a crystal parent although a presentation of an inorganic system fluorescent substance in this invention does not have restriction in particular, A metallic oxide and ZnS which are represented by Zn_2SiO_4, $Ca_5(PO_4)_3Cl$, etc., What combined ion of metal, such as ion of rare earth metals, such as Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, and Yb, Ag, aluminum, Mn, In, Cu, and Sb, with a sulfide represented by SrS, CaS, etc. as an activator or a coactivator is preferred.

[0144]When a crystal parent is explained in more detail, as a crystal parent, a metallic oxide is preferred, For example, $(X)_3aluminum_{16}O_{27}$, $(X)_4aluminum_{14}O_{25}$, $(X)_3aluminum_2Si_2O_{10}$, $(X)_4Si_2O_8$, $(X)_2Si_2O_6$, $(X)_2P_2O_7$, $(X)_2P_2O_5$, $(X)_5(PO_4)_3Cl$, and $(X)_2Si_3O_8-2(X)Cl_2$[Here, X expresses alkaline-earth metals. Single components or two or more kinds of mixed ingredients may be sufficient as alkaline-earth metals expressed with X, and the mixing ratio may be arbitrary. An aluminum oxide, silicon oxide, phosphoric acid, halo phosphoric acid, etc. which were replaced with alkaline-earth metals like] are mentioned as a typical crystal parent.

[0145]As other desirable crystal parents, zincky oxide and sulfide, yttrium, and GADORIUMU, What blended arbitrary metallic elements with sulfides, and those oxides and sulfides of a thing (sulfide) which changed a part of oxide of rare earth metals, such as a lantern, and oxygen of the oxide to a sulfur atom, and a rare earth metal is mentioned.

[0146]Desirable examples of a crystal parent are enumerated below.

[0147]ZnS, Y_2O_2S, $Y_3aluminum_5O_{12}$, Y_2SiO_{10}, Zn_2SiO_4, Y_2O_3, $BaMgAl_{10}O_{17}$, $BaAl_{12}O_{19}$, O-aAl(Ba, Sr, Mg)$_2O_3$, (Y, Gd)BO_3, S (Zn, Cd), $SrGa_2S_4$, SrS, GaS, SnO_2, and $Ca_{10}(PO_4)_6$ (F.) Cl)$_2$, aluminum(Mg (Ba, Sr), Mn)$_{10}O_{17}$, (Sr, Ca, Ba, Mg)$_{10}(PO_4)_6Cl_2$, (La, Ce)PO_4, $CeMgAl_{11}O_{19}$, $GdMgB_5O_{10}$, $Sr_2P_2O_7$, They are $Sr_4aluminum_{14}O_{25}$, Y_2SO_4, Gd_2O_2S, Gd_2O_3, YVO_4, Y(P, V)O_4, etc.

[0148]What is necessary is for what was replaced with an element of the same family in part to be sufficient as the above crystal parent and activator, or coactivator, and for there to be no restriction in particular in elementary composition, to absorb light of an ultraviolet region, or light of a purple field, and just to emit visible light.

[0149]In this invention, a thing desirable as an activator of an inorganic fluorescent substance and a coactivator, Metal of ion of a lanthanoids represented by La, Eu, Tb, Ce, Yb, Pr, etc., Ag, Mn, Cu, In, aluminum, etc. It is ion, and 0.001-100-mol% of the doped quantity is desirable to a parent, and is still more desirable. [0.01-50 mol% of]

[0150]An activator and a coactivator are doped in the crystal by transposing some ion which constitutes a crystal parent to ion like the above-mentioned lanthanoids.

[0151]If a actual presentation of a fluorescent substance crystal is indicated strictly, it will become the following empirical

formulas, but since size of quantity of an activator does not affect an essential fluorescent characteristic in many cases, as long as there is no notice, suppose below that a numerical value of following x or y is not indicated especially. For example, Sr_{4-x}aluminum$_{14}O_{25}:Eu^{2+}_x$ writes it as Sr_4aluminum$_{14}O_{25}:Eu^{2+}$ in this invention.

[0152]Although an empirical formula of a typical inorganic fluorescent substance (a crystal parent and an inorganic fluorescent substance constituted with an activator) is indicated below, this invention is not limited to these. $(Ba_zMg_{1-z})_{3-x-y}$aluminum$_{16}O_{27}:Eu^{2+}_x$, Mn^{2+}_y, Sr_{4-x}aluminum$_{14}O_{25}:Eu^{2+}_x$, $(Sr_{1-z}Ba_z)_{1-x}$aluminum$_2Si_2O_8:Eu^{2+}_x$, $Ba_{2-x}SiO_4:Eu^{2+}_x$, $Sr_{2-x}SiO_4:Eu^{2+}_x$, $Mg_{2-x}SiO_4:Eu^{2+}_x$, $_{1-x}$(BaSr) SiO4:Eu^{2+}_x, $Y_{2-x-y}SiO_5:Ce^{3+}_x$, Tb^{3+}_y, $Sr_{2-x}P_2O_5:Eu^{2+}_x$, $Sr_{2-x}P_2O_7:Eu^{2+}_x$, $_{5-x}(Ba_yCa_zMg_{1-y-z})(PO_4)_3Cl:Eu^{2+}_x$, $Sr_{2-x}Si_3O_8-2SrCl_2:Eu^{2+}_x$[x, y, and z express one or less arbitrary numbers, respectively.]

Although an inorganic fluorescent substance preferably used for below by this invention is shown, this invention is not limited to these compounds.

[Blue light inorganic matter fluorescent compound]

(BL-1) $Sr_2P_2O_7:Sn^{4+}$ (BL-2) Sr_4aluminum$_{14}O_{25}:Eu^{2+}$ (BL-3) $BaMgAl_{10}O_{17}:Eu^{2+}$ (BL-4). $SrGa_2S_4:Ce^{3+}$ (BL-5) $CaGa_2S_4:Ce^{3+}$(BL-6) aluminum(Mg (Ba, Sr), Mn) $_{10}O_{17}:Eu^{2+}$ (BL-7) (Sr and Ca —) [Ba and] Mg) $_{10}(PO_4)_6Cl_2:Eu^{2+}$ (BL-8) $BaAl_2SiO_8:Eu^{2+}$ (BL-9) $Sr_2P_2O_7:Eu^{2+}$ (BL-10). Sr_5. $(PO_4)_3Cl:Eu^{2+}$(BL-11) $_5$(Sr, Ca, Ba) $(PO_4)_3Cl:Eu^{2+}$ (BL-12) $BaMg_2$aluminum$_{16}O_{27}:Eu^{2+}$ (BL-13). (Ba, Ca) $_5(PO_4)_3Cl:Eu^{2+}$ (BL-14) $Ba_3MgSi_2O_8:Eu^{2+}$ (BL-15) $Sr_3MgSi_2O_8:Eu^{2+}$[green emission inorganic matter fluorescent compound].

(GL-1) (.) BaMgaluminum$_{16}O_{27}:Eu^{2+}$ and Mn^{2+}(GL-2) Sr_4aluminum$_{14}O_{25}:Eu^{2+}$(GL-3) (SrBa) aluminum$_2Si_2O_8:Eu^{2+}$ (GL-4). (BaMg) $_2SiO_4:Eu^{2+}$. (GL-5). $Y_2SiO_5:Ce^{3+}$, Tb^{3+}. (GL-6) $Sr_2P_2O_7-Sr_2B_2O_5:Eu^{2+}$ (GL-7) $(BaCaMg)_5(PO_4)_3Cl:Eu^{2+}$ (GL-8). $Sr_2Si_3O_8-2SrCl_2:Eu^{2+}$ (GL-9) Zr_2SiO_4, $MgAl_{11}O_{19}$:. Ce^{3+}, Tb^{3+} (GL-10) $Ba_2SiO_4:Eu^{2+}$ (GL-11) $Sr_2SiO_4:Eu^{2+}$ (GL-12) (BaSr) $SiO_4:Eu^{2+}$[red light inorganic matter fluorescent compound]

(RL-1). $Y_2O_2S:Eu^{3+}$ (RL-2). $YAlO_3:Eu^{3+}$ (RL-3). $Ca_2Y_2(SiO_4)_6:Eu^{3+}$ (RL-4) $LiY_9(SiO_4)_6O_2:Eu^{3+}$ (RL-5) $YVO_4:Eu^{3+}$ (RL-6). An inorganic fluorescent substance used for $CaS:Eu^{3+}$ (RL-7) $Gd_2O_3:Eu^{3+}$ (RL-8) $Gd_2O_2S:Eu^{3+}$ (RL-9) Y(P, V) $O_4:Eu^{3+}$ this invention from a viewpoint of luminescence intensity. It does not pass through a mechanical disruption process at the time of manufacture, i.e., what is compounded by the build up method is preferred, and what is manufactured by a liquid phase process especially by the Sol-Gel method etc. is preferred. A presentation top has that preferred from which an inorganic oxide serves as a parent.

[0153]Although written to the Sumio Sakuhana work "application of a sol-gel method" (company issue of the 1997 AGUNE ** style) as a manufacturing method by the Sol-Gel method in detail, for example, With the "Sol-Gel method" as used in the field of [fundamentally, leaves a solution, means how to compound material at low temperature rather than scorification through solation of a solution, and gelling, and] this invention. It can point out performing a reaction in a liquid phase process at at least 1 process of fluorescent substance manufacture, and can distinguish from a synthetic method performed at a melting reaction applied to the usual inorganic fluorescent substance composition. The Sol-Gel method of this invention, They are for example, a tetramethoxy silane ($Si(OCH_3)_4$) and europium 2,4-pentane JIONETO (Eu^{3+} ($CH_3COCH=C(O^{-})$)) about an element (metal) generally used for a parent, an activator, or a coactivator. - A double alkoxide which adds and makes a metal simple substance to metal alkoxides, such as CH_{33}, metal complexes, or those organic solvent solutions (for example, Mg which adds and makes metal magnesium in a 2-butanol solution of aluminum(OBu) $_3$) [aluminum(OBu) $_3$] $_2$ etc. carry out initial-complement mixing as a metal halogenide, metal salt of organic acid, and a metal simple substance, a manufacturing method by carrying out a polycondensation thermally or chemically by a liquid phase state is meant, and calcination, reduction processing, etc. may be performed if needed.

[0154]With "metal" of a metal alkoxide, a metal halogenide and metal salt which are used by this invention, or metal. All the elements of "a transition metal (Transition Metals)", [others / "the metal (Metals)" generally defined by the periodic table etc.] A definition is given as a thing having contained all the elements of a "lanthanoids", all the elements of "actinoid" and boron defined as "a nonmetal (Non Metals)", and silicon (silicon).

[0155]The above-mentioned inorganic fluorescent substance may perform surface treatment processing if needed, and what is depended on physical processing by addition of what is depended on chemical preparation, such as a silane coupling agent, as the method, particles of a submicron order, etc., a thing further depended on those concomitant use, etc. are mentioned.

[0156]As a silane coupling agent used by this invention, Can use as it is what is written in a "NUC silicone silane coupling agent" catalog of the Nippon Unicar, Inc. issue (August 2, 1997), and as the example, For example, beta -(3,4-epoxycyclohexyl)- Ethyl trialkoxysilane, Glycidyloxy ethyltriethoxysilane, a gamma-acryloyloxy n-propyltri-n-propyloxy silane, A gamma-methacryloyloxy n-propyl-n-propyloxy silane, A JI (gamma-acryloyloxy n-propyl) di-n-propyloxy silane, An acryloyloxy dimethoxyethylsilane, N-beta (aminoethyl) gamma-aminopropyl trimethoxysilane, N-beta (aminoethyl) gamma-aminopropyl methyl dimethoxysilane, gamma-aminopropyl triethoxysilane, N-phenyl-gamma-aminopropyl trimethoxysilane, gamma-mercapto propyltrimethoxysilane, etc. are mentioned.

[0157]As particles used by this invention, it is preferred that they are inorganic particles, for example, particles, such as silica, a titania, zirconia, and a zinc oxide, are mentioned.

[0158]When manufacturing especially by the Sol-Gel method, after patterning liquid containing a precursive solution or a primary particle of a fluorescent substance after a transparent substrate by print processes, the ink jet method, etc., crystallization treatment, such as calcination and reduction processing, or rise-in-luminosity processing may be performed.

[0159]Next, as a rare earth complex system fluorescent substance in this invention, As an organic ligand which what has Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, etc. as a rare earth metal is mentioned, and forms a complex, A compound which either an aromatic

system or a non-aromatic system is OK as, and is preferably expressed with a following general formula (1) or a general formula (R2) is preferred.

[0160]General formula (1)

The inside of a Xa-(La)-(Lb)n-(Lc)-Ya[type, La, Lb, Lc expresses an atom which has two or more joint hands independently, respectively, n expresses 0 or 1, Xa expresses a substituent which has an atom which can be configurated at least in contiguity of La, and Ya expresses a substituent which has an atom which can be configurated at least in contiguity of Lc. Furthermore arbitrary portions and La of Xa are condensed mutually, a ring may be formed, arbitrary portions and Lc(s) of Ya are condensed mutually, a ring may be formed, La and Lc are condensed mutually, a ring may be formed, and aromatic hydrocarbon rings or at least one aromatic heterocycle exists in intramolecular further. Xa-(La)-(Lb)n-(Lc)-Ya However, beta-diketone derivative and beta-ketoester derivative, What transposed a beta-keto amide derivative or an oxygen atom of said ketone to a sulfur atom or -N(R1)-, When it expresses crown ether which transposed an oxygen atom of crown ether, azacrown ether, thia crown ether, or crown ether to arbitrary number sulfur atoms or -N(R1)-, there may not be aromatic hydrocarbon rings or an aromatic heterocycle.]

In a general formula (1), it is preferred that atoms which are expressed with Xa and Ya and which can be configurated are specifically an oxygen atom, a nitrogen atom, a sulfur atom, a selenium atom, and a tellurium atom, and are especially an oxygen atom, a nitrogen atom, and a sulfur atom.

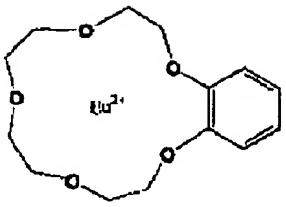
[0161]although there is no restriction in particular as an atom which has two or more joint hands of being expressed with La, Lb, and Lc, in a general formula (1) and a carbon atom, an oxygen atom, a nitrogen atom, a silicon atom, a titanium atom, etc. are mentioned typically — this — better — that of a potato is a carbon atom.

[0162]Although an example of a rare earth complex system fluorescent substance expressed with a general formula (1) below is shown, this invention is not limited to these.

[0163]

[Formula 54]

RE-1



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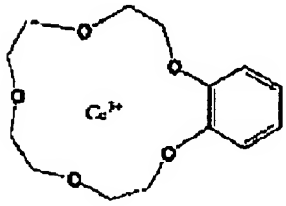

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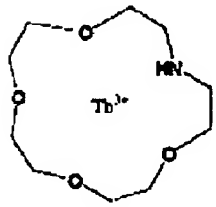

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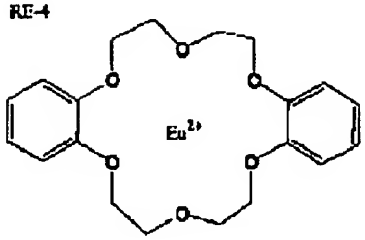

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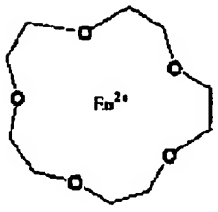

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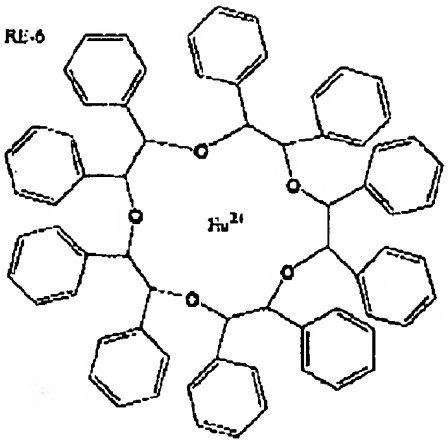

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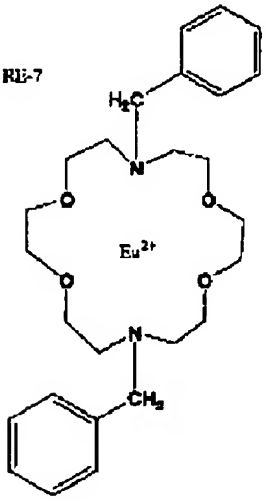

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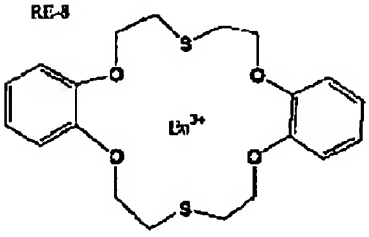
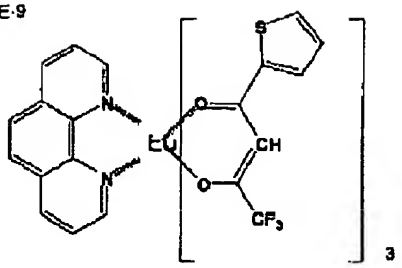


[0164]

[Formula 55]

RE-9



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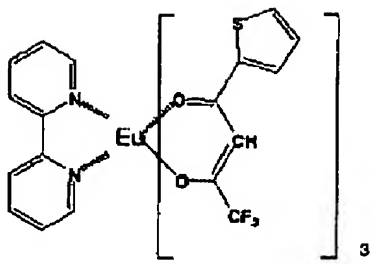

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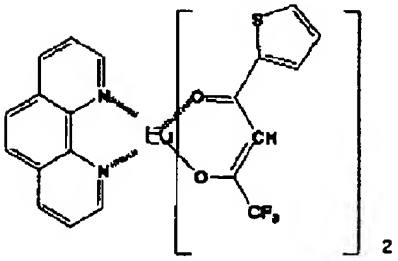

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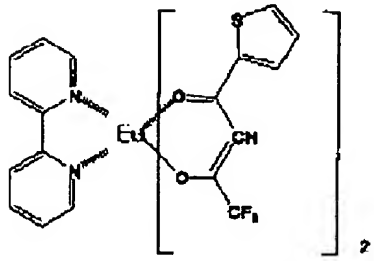

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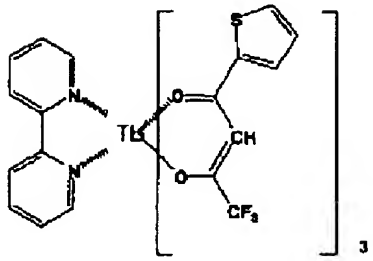

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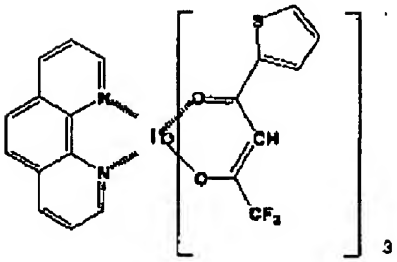

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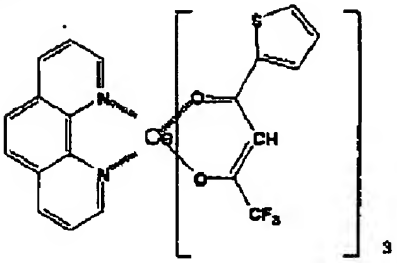
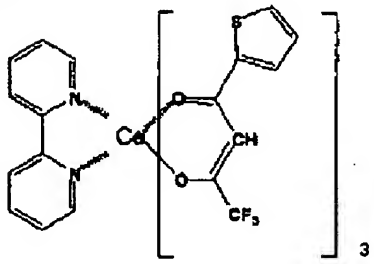


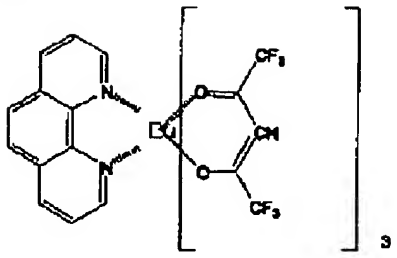
RE-16



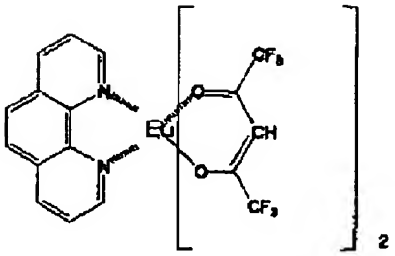
[0165]

[Formula 56]

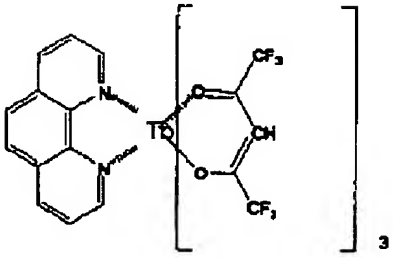
RE-17



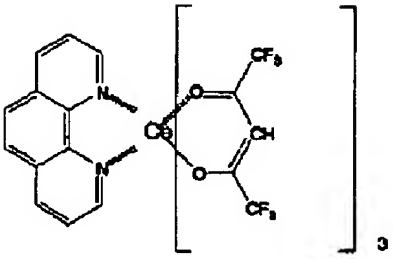
RE-18



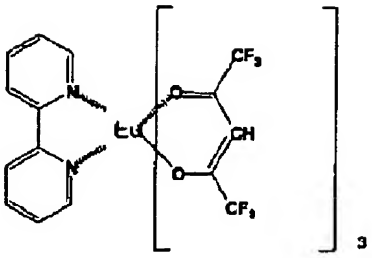
RE-19



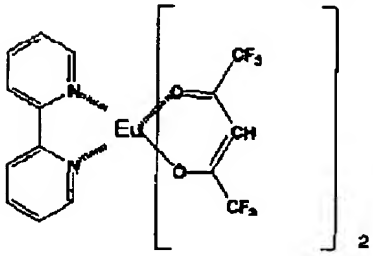
RE-20



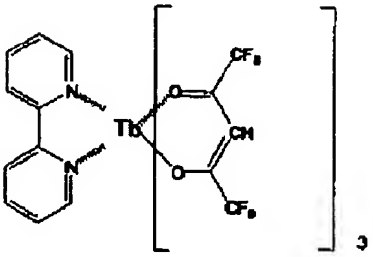
RE-21



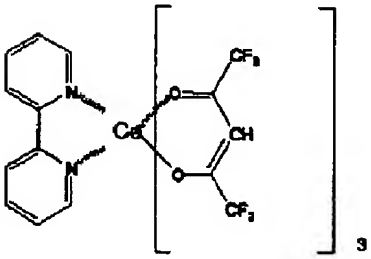
RE-22



RE-23



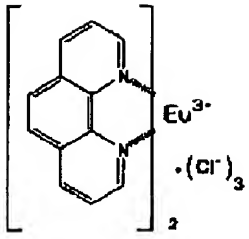
RE-24



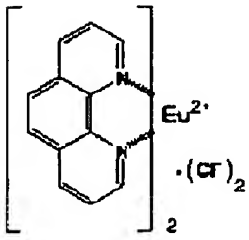
[0166]

[Formula 57]

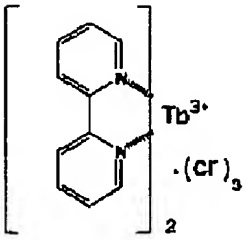
RE-25



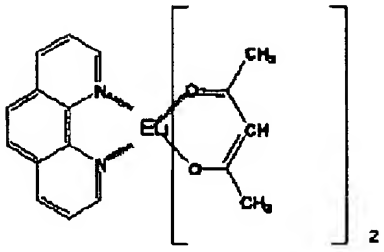
RE-26



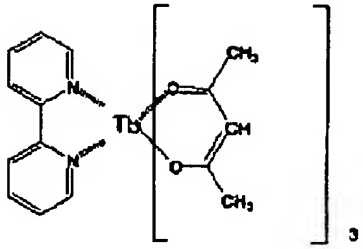
RE-27



RE-28



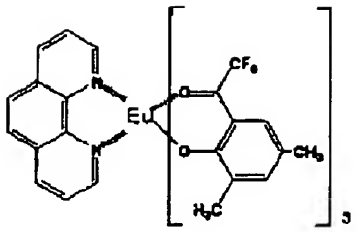
RE-29



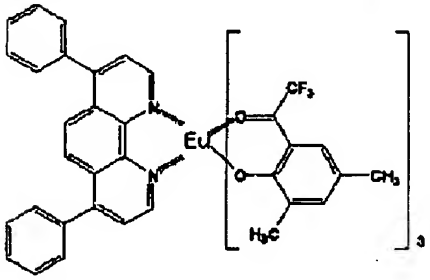
[0167]

[Formula 58]

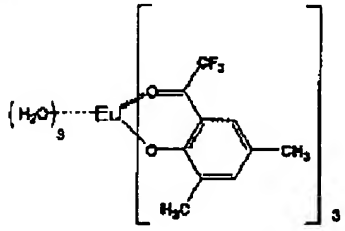
RF-1



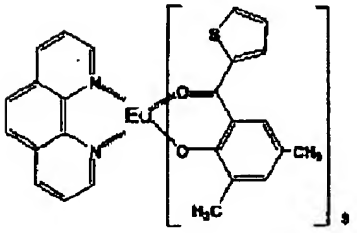
RF-2



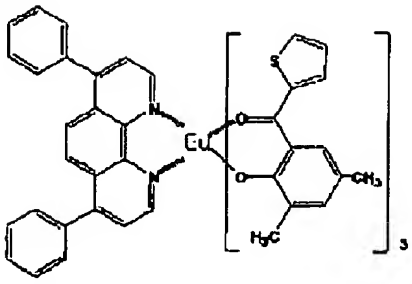
RF-3



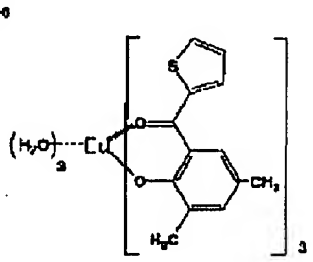
RF-4



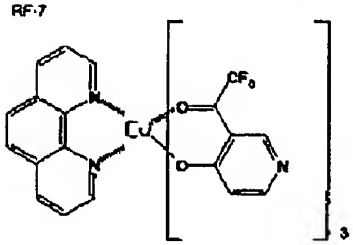
RF-5



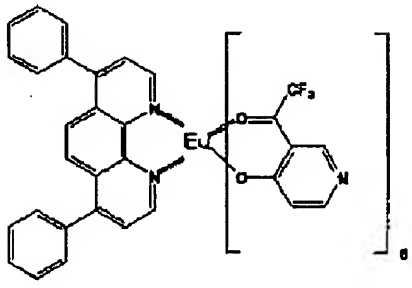
RF-6



RF-7



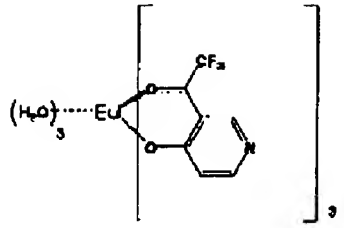
RF-8



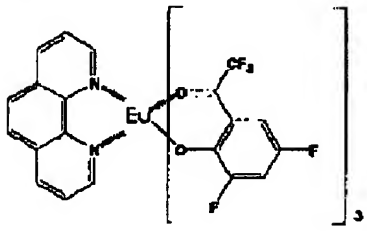
[0168]

[Formula 59]

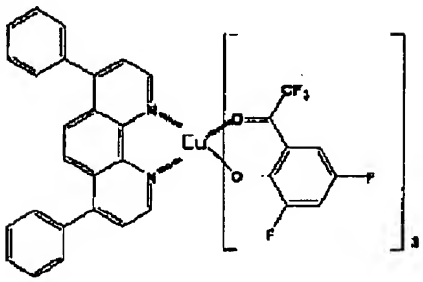
RF-9



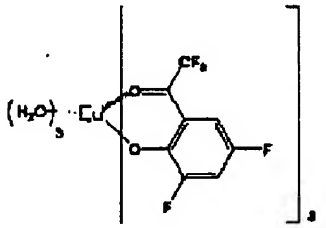
RF-10



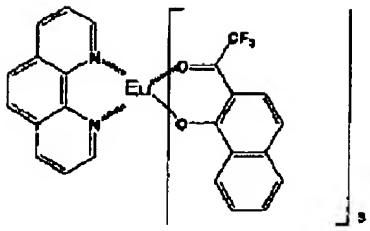
RF-11



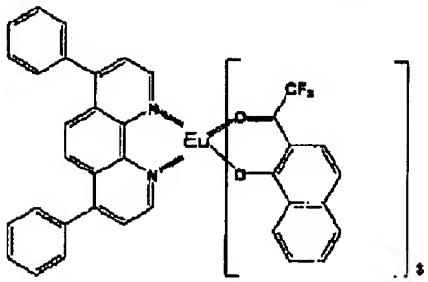
RF-12



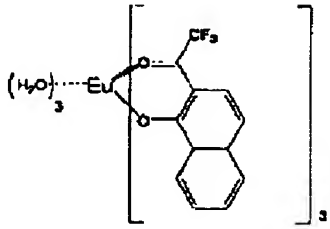
RF-13



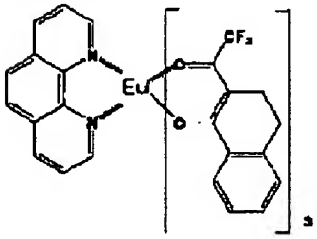
RF-14



RF-15



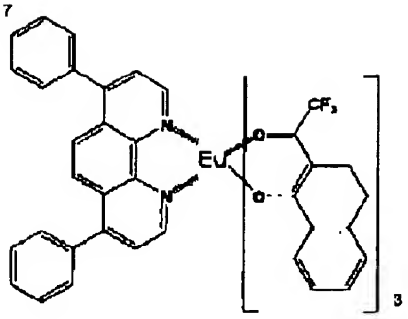
RF-16



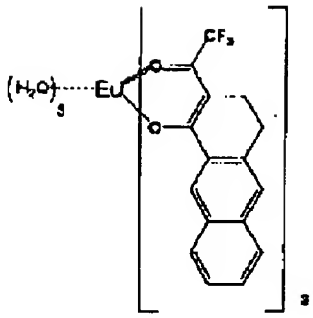
[0169]

[Formula 60]

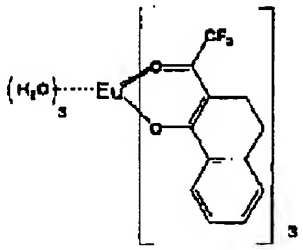
RF-17



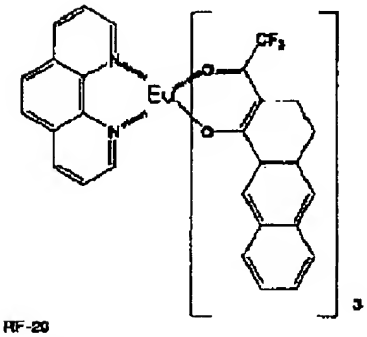
RF-21



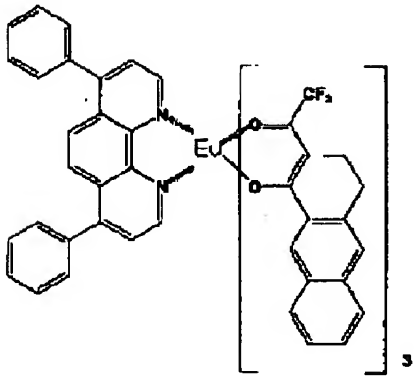
RF-18



RF-19



RF-20



[0170]Next, the color conversion filter in this invention is explained.

[0171]The color conversion filter as used in the field of this invention is a wavelength changing element used for changing the color (luminescent color) of a light source into a desired color, Fundamentally, rather than the maximum maximum wavelength of a light source, are a wavelength changing element which can change wavelength into not less than 10-nm long wavelength, and as a concrete use, The filter for full color displays indicated to JP,3-152897,A, 9-245511, 11-297477, etc. (in green and red from a blue light source) [change and] The color conversion filter which enables luminescence of blue, green, and red by arranging them to stripe shape, The filter for white light for the back lights of lighting or a liquid crystal display (color conversion filter which makes the light of a 400-700-nm visible region emit light broadly), A neon sign, the filter for partial luminescence of the instruments of a car (color conversion filter for displaying a color required for a place as occasion demands), etc. are mentioned as the example of representation.

[0172]

[Example]Although an example is given and this invention is explained in detail hereafter, the mode of this invention is not limited to this.

[0173]After patterning after the substrate (NA-45 by a NH techno glass company) which formed 150 nm of ITO(s) on glass as the production anode of an EXAMPLE (1-1) electroluminescent element (UV-1), The transparent supporting board which provided this ITO transparent electrode was cleaned ultrasonically with isopropyl alcohol, it dried with dry nitrogen gas, and UV ozone wash was performed for 5 minutes. This transparent supporting board is fixed to the substrate holder of a commercial vacuum evaporator, and, on the other

hand, it is a N,N'-diphenyl-N,N'-screw (3-methylphenyl) to the resistance heating boat made from molybdenum. [1,1'-biphenyl] -Put in 200 mg of 4,4'-diamine (TPD), and 200 mg of p-KUUO terphenyl (PQP) is put into another resistance heating boat made from molybdenum, 200 mg of tris(8-hydroxyquinolinate)aluminium (Alq_3) was put into another resistance heating boat made from molybdenum, and it attached to the vacuum evaporator. Subsequently, after decompressing a vacuum chamber to $4x10^{-4}$Pa, it energized to said heating boat containing TPD, heated to 220 **, and vapor-deposited to the transparent supporting board with the evaporation rate of 0.1-0.3nm/sec, and the hole injection layer of 60 nm of thickness was formed. Said heating boat containing PQP was energized, and it heated to 220 **, it vapor-deposited on said hole injection layer with the evaporation rate of 0.1-0.3nm/sec, and the luminous layer of 40 nm of thickness was provided. Said heating boat containing Alq_3 was energized, and it heated to 250 **, it vapor-deposited on said luminous layer with the evaporation rate of 0.1nm/sec, and the electronic injection layer of 20 nm of thickness was formed. The substrate temperature at the time of vacuum evaporation was a room temperature. Next, open a vacuum chamber and the rectangular-holes vacancy mask made from stainless steel is installed on an electronic injection layer, On the other hand, put the magnesium 3g into the resistance heating boat made from molybdenum, and 0.5g of silver is put into the basket for vacuum evaporation made from tungsten, After decompressing a vacuum chamber to $2x10^{-4}$Pa again, energize on the boat containing magnesium and magnesium is vapor-deposited with the evaporation rate of 1.5-2.0nm/sec, Under the present circumstances, electroluminescent element UV-1 was produced by heating a silver basket simultaneously, vapor-depositing silver with the evaporation rate of 0.1nm/sec, and considering it as the counterelectrode which consists of a mixture of said magnesium and silver.

[0174]When 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver, luminescence with a luminescence maximum wavelength of 380 nm was obtained.

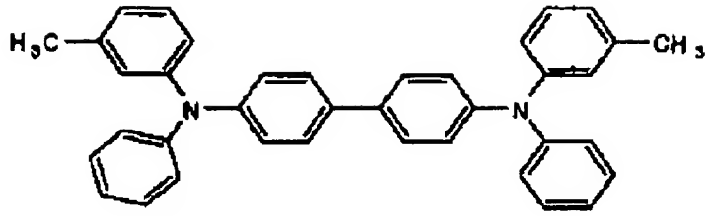
[0175]An example. (1-2) . The electroluminescent element for comparison. The electroluminescent element for comparison (B-1) produced by the completely same method as (1-1) was produced except having transposed photogen p-KUUO terphenyl (PQP) of production (1-1) of (B-1) to 4,4'-bis(2,2'-diphenylvinyl)biphenyl (DPVBi).

[0176]When 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver, blue luminescence with a luminescence maximum wavelength of 475 nm was obtained.

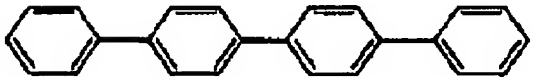
[0177]

[Formula 61]

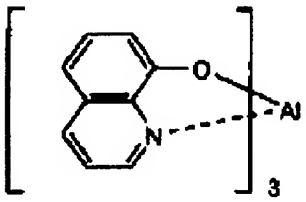
TPD



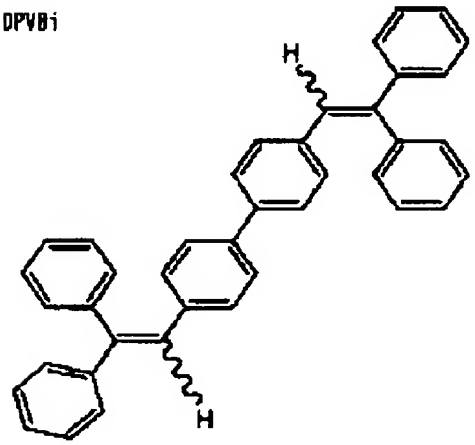
PQP



Alq3



DPVBi



[0178]EXAMPLE (2-1) 150 ml of ethanol and 150 ml of water were added to the ammonia solution containing ammonia of 0.016 mol of composition of illustration compound (GL-10) $Ba_2SiO_4:Eu^{2+}$, and lye was produced.

[0179]Furthermore, 8.33g of tetraethoxysilanes, adding stirring the solution which dissolved (0.04 mol) and the europium (III) acetylacetonato complex 2 hydrate 0.097g (0.2 millimol) in 150 ml of ethanol by dropping speed about 1 ml/min in said lye under a room temperature — sol — liquid was adjusted. The obtained sol is condensed about 15 times (about 30 ml) by an evaporator, 295 ml added to this and it was made to gel the barium nitrate solution of 0.3 mol/l.

[0180]The obtained moist gel was ripened at 60 ** among the well-closed container overnight. Stirring distribution was carried out into ethanol (about 300 ml) after that, and it isolated preparatively by the suction filtration using a filter paper (Advantec 5A), and dried at the room temperature. Inorganic fluorescent substance which dry gel performs heat treatment at 1000 ** among H2-N2 atmosphere 5% for 2 hours, and shines in thin green under sunlight GL-10 ($Ba_2SiO_4:Eu^{2+}_{0.005}$) 2.7g was obtained.

[0181]The XRD spectrum analyzed the component composition of GL-10. It turned out that the main ingredients are Ba_2SiO_4 and the accessory constituents contained in very small quantities are $BaSiO_3$ and Ba_3SiO_5 as a result.

[0182]It turned out that it is a fluorescent substance in which the mean particle diameter of GL-10 emits light in 1.05-micrometer green, and a luminescence maximum wavelength emits light in 500 nm (405 nm of excitation light) green.

[0183]The red light particle inorganic fluorescent substance (RL-5) (the mean particle diameter of about 0.85 micrometer, maximum luminous wavelength of 610 nm (375 nm of excitation light)) and the blue light inorganic fluorescent substance (BL-3) (the mean particle

diameter of 0.90 micrometer, maximum luminous wavelength of 432 nm (375 nm of excitation light)) were obtained in the similar way.

[0184]EXAMPLE (2-2) 15g of ethanol and 0.22 g of gamma **GURISHIDOKI Cipro pill triethoxysilane were added to 0.16 g of Aerosil with a surface physical property refining mean particle diameter of 5 nm of a particle inorganic fluorescent substance, and it stirred under the open system room temperature for 1 hour. moving these mixture and 20 g of inorganic fluorescent substances (GL-10) to a mortar, and often heating in 120 more ** oven in 70 ** oven after pickpocket ****** for 2 hours for 2 hours — surface treatment — having carried out (GL-10) — it obtained.

[0185]Surface treatment of RL-5 and BL-3 was performed similarly.

[0186]the inorganic fluorescent substance (RL-5) of surface physical property improvement this invention of an EXAMPLE (2-3) comparison inorganic fluorescent substance — KX-605 ($Zn_2SiO_4:Mn^{2+}$,) by Kasei Optonix, Ltd. Surface treatment of KX-605 was performed by the completely same method as the method of the above-mentioned (2-2) statement except having transposed to the mean particle diameter of 7 micrometers, and the maximum luminous wavelength of 570 nm (343 nm of excitation light).

[0187]EXAMPLE (3-1) to 10 g of red light inorganic fluorescent substances (RL-5) of this invention which gave surface treatment of the production above of the color conversion filter using an inorganic fluorescent substance. After adding and stirring 30 g of butyral (BX-1) dissolved with the mixed solution (300g) of toluene/ethanol =1/1, it applied on glass by 200 micrometers of Wet thickness. Stoving of the obtained applied glass was carried out in 100 ** oven for 4 hours, and the color conversion filter (F-1) of this invention was created.

[0188]The color conversion filter (F-3) which painted the color conversion filter (F-2) and blue light inorganic fluorescent substance (BL-3) which painted the green emission inorganic fluorescent substance (GL-10) by the same method as this was created.

[0189]The convert-colors light filter for comparison (F-4) which painted comparison inorganic fluorescent substance KX-605 (what performed surface treatment processing) in the similar way was created.

[0190]To color conversion filter F-1 of this invention, F-2, and F-3 being transparent filters almost in colorlessness, the comparative color conversion filter F-4 became muddy white, and did not almost have a light transmittance state.

[0191]As for visible light transmittance, in F-2, F-3 was [F-1 / F-4] 4% 57% 57% 54%.

[0192]EXAMPLE (3-2) 3 g of rare earth complex system fluorescent substances (RE-17) of this invention are dissolved in 30 g of butyral (BX-1) dissolved with the mixed solution (300g) of creation toluene / ethanol =1/1 of the color conversion filter using a rare earth complex system fluorescent substance, Warm air desiccation was applied and carried out by 150 micrometers of Wet thickness on the 80-micrometer-thick polyether sulphone (PES) film, and the color conversion filter (F-5) of the red light of this invention was created.

[0193]Like this, RE-23 was used instead of RE-17 and the color conversion filter (F-6) of the green emission of this invention was created.

[0194]RE-1 was used instead of RE-17 and the color conversion filter (F-7) of the blue light of this invention was created.

[0195]EXAMPLE (3-3) Creation of the color conversion filter using a fluorochrome (comparison)

It is a fluorochrome instead of RE-17 of the above (3-2). Coumarin 6 2.0 g and fluorescent pigment solvent yellow 116 The color conversion filter (F-8) of the blue optical-pumping green emission which is compared by the same method as (3-2) was created except having changed to 0.5 g.

[0196]The fluorescent pigment solvent yellow 116 instead of RE-17 of (3-2) 1.0 g, The color conversion filter (F-9) of the blue optical-pumping red light which is compared by the same method as (3-2) about the basic violet 11 except having changed 0.5g and rhodamine 6G to 0.5 g was created.

[0197]When the electroluminescent element (UV-1) produced by (1-1) and the color conversion filter (F-1) produced by (3-1) are piled up and 12V direct current voltage is applied under a dry nitrogen gas atmosphere, the luminosity which emits light from a color conversion filter is 26 cd/m^2.

It observed that red (red) luminescence had come out of a CIE chromaticity coordinate by x= 0.64 and y= 0.29.

[0198]EXAMPLE (4-1) (evaluation of the luminous efficiency of an electroluminescent element, a life, and a color tone)

Put the color conversion filter of this invention, or a comparative color conversion filter on each of an electroluminescent element (UV-1) and the electroluminescent element for comparison (B-1) so that a fluorescent substance layer may face the light-emitting surface of an electroluminescent element, and The temperature of 23 **, The continuous light by 12V direct-current-voltage impression was performed under a dry nitrogen gas atmosphere, and time to halve the luminous efficiency (lm/W) at the time of a lighting start and luminosity was measured. Luminous efficiency was expressed with the relative value when luminous efficiency of sample No.7 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.8 to 100. A result is shown in Table 1.

[0199]

[Table 1]

No.	エレクトロルミネッセンス素子	色変換フィルター	発光効率（相対値）	発光色	連続発光後の輝度半減時間（相対値）	備考
1	UV−1	F−1	71	赤	169	本発明
2	UV−1	F−5	68	赤	156	本発明
3	B−1	F−9	25	赤	103	比較例
4	UV−1	F−2	165	緑	186	本発明
5	UV−1	F−4	15	緑	161	比較例
6	UV−1	F−6	155	緑	162	本発明
7	B−1	F−8	100	青	100	比較例
8	UV−1	F−3	111	青	188	本発明
9	UV−1	F−7	108	青	169	本発明

[0200]From Table 1, compared with sample No.3 of comparison, luminous efficiency is high and the electroluminescent element (sample No.1 and 2) which has a color conversion filter of this invention which emits light in red found a long time also for the life. Furthermore, the luminescent color was also a color tone with the more preferred sample of this invention.

[0201]The electroluminescent element (sample No.4 and 6) which has a color conversion filter of this invention which emits light green was understood that luminous efficiency is overwhelmingly high compared with sample No.5 of comparison which uses the conventional inorganic system fluorescent substance for a color conversion filter. Even if compared with sample No.7 which is furthermore the combination of the electroluminescent element of blue light, and a color conversion filter, luminous efficiency was high and the life also found a long time. It was a color tone whose luminescent color is also still more preferred than a comparison sample.

[0202]Also in sample No.8 of this invention which emits light still bluer, and 9, high luminous efficiency and high temporal stability were checked.

[0203]EXAMPLE (5-1) (evaluation of a LED element)

When voltage was applied in piles, respectively and light was emitted in the color conversion filter (F-1) of this invention, and (F-5) so that a fluorescent substance layer might approach the LED element side at the ultraviolet luminescence LED element by Nichia Chemical Industries, Ltd. (UV LED Lamp), luminosity and a color tone emitted good red light. When voltage was applied in piles, respectively and light was similarly emitted in the color conversion filter (F-2) of this invention, and (F-6), luminosity and a color tone emitted good green light. When voltage was applied in piles, respectively and light was similarly emitted in the color conversion filter (F-3) of this invention, and (F-7), luminosity and a color tone emitted good blue glow.

[0204]EXAMPLE (6-1) the compound N-7 of this invention. The electroluminescent element for comparison (S-N7) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-N7) to the compound N-7 of this invention. It produced.

[0205]Purple luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.

[0206]EXAMPLE (6-2) compound-A-3 of this invention. The electroluminescent element for comparison (S-A3) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-A3) to compound-A-3 of this invention. It produced.

[0207]When 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver, luminescence of the lavender color was obtained.

[0208]EXAMPLE (6-3) the compound B-1 of this invention. The electroluminescent element for comparison (S-B1) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-B1) to the compound B-1 of this invention. It produced.

[0209]Purple luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.

[0210]EXAMPLE (6-4) the compound D-5 of this invention. The electroluminescent element for comparison (S-D5) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-D5) to the compound D-5 of this invention. It produced.

[0211]Purple luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.

[0212]EXAMPLE (6-5) compound-F-1 of this invention. The electroluminescent element for comparison (S-F1) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-F1) to compound-F-1 of this invention. It produced.

[0213]Purple luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.

[0214]EXAMPLE (7-1) (near-ultraviolet [of this invention] - evaluation of a purple luminescent compound)

As the electroluminescent element of near-ultraviolet [which was created by above-mentioned example (6-1) - (6-5)] - purple luminescence, and its comparison. It is a color conversion filter of this invention to each of the electroluminescent element (UV-1) created using the conventional luminescent material created by EXAMPLE (1-1). Pile up F-2 so that a fluorescent substance layer may face the light-emitting surface of an electroluminescent element, and Temperature of 23 **, The continuous light by 15V direct-current-voltage

impression was performed under a dry nitrogen gas atmosphere, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.701 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.701 to 100. A result is shown in Table 2.

[0215]

[Table 2]

No.	エレクトロルミネッセンス素子	色変換フィルター	発光輝度（相対値）	発光色	連続発光後の輝度半減時間（相対値）	備考
701	UV－1	F－2	100	緑	100	本発明
702	S－N7	F－2	178	緑	227	本発明
703	S－A3	F－2	456	緑	340	比較例
704	S－B1	F－2	320	緑	270	本発明
705	S－D5	F－2	540	緑	215	比較例
706	S－F1	F－2	312	緑	359	本発明

[0216]The electroluminescent element (S-N7, S-A3, S-B1, S-D5, S-F1) which uses the luminescent compound (N-1, A-3, B-1, D-5, F-1) of this invention so that more clearly than Table 2, Compared with the electroluminescent element (UV-1) using the conventional luminescent compound, the light emitting luminance at the time of using the same color conversion filter was dramatically high, and it turned out that a life is also improved further substantially.

[0217](Production of the electroluminescent element which uses the compound of this invention which emits light to a visible region) EXAMPLE (8-1) the compound C-8 of this invention. The electroluminescent element for comparison (S-C8) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-C8) to the compound C-8 of this invention. It produced.

[0218]When 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver, luminescence of blue-green was obtained.

[0219]EXAMPLE (8-2) compound-E-1 of this invention. The electroluminescent element for comparison (S-E1) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-E1) to compound-E-1 of this invention. It produced.

[0220]Green luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.

[0221]EXAMPLE (8-3) compound-F-7 of this invention. The electroluminescent element for comparison (S-F7) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-F7) to compound-F-7 of this invention. It produced.

[0222]Blue luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.

[0223](Performance comparison with the compound of this invention, and the publicly known analogue)

EXAMPLE (9-1) — the electroluminescent element of composition of being shown in Drawing 101 was produced using the same method as the production examples (1-1) of a comparative electroluminescent element (CF-1).

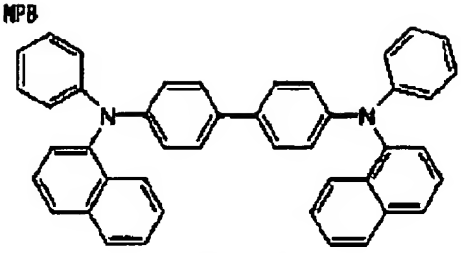
[0224]By a thickness of 70 nm, for NPB Zn(BOX) 2 to the electron hole transporting bed of the 1st layer at the luminous layer of the 2nd layer by a thickness of 50 nm. Electroluminescent element CF-1 of comparison was produced by the completely same technique as the electroluminescent element (UV-1) of an example (1-1) except having laminated OXD-7 by a thickness of 30 nm to the electron transport layer of the 3rd layer.

[0225]Blue luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.

[0226]

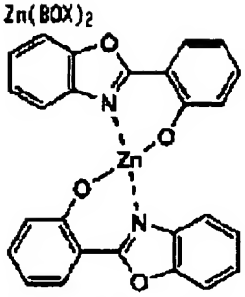
[Formula 62]

NPB



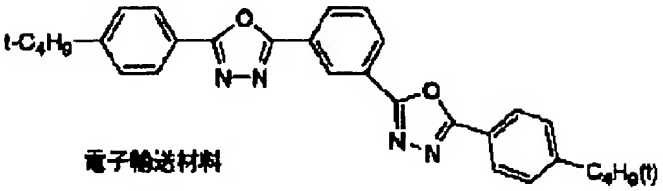
正孔輸送材料

$Zn(BOX)_2$



発光材料

OXD-7



電子輸送材料

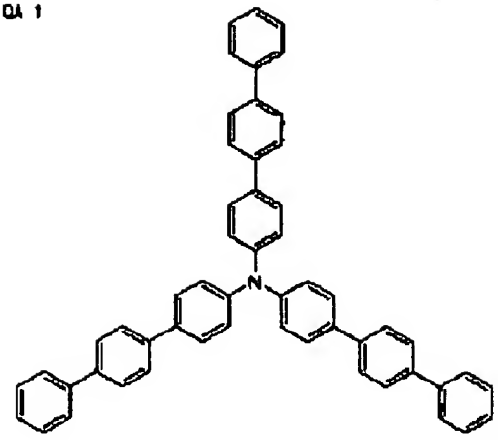
[0227]EXAMPLE (9-2) — doria — performance comparison (evaluation as a hole transporting material) of a reel amine compound
The electroluminescent element (9201-9214) which changed only NPB which is a hole transporting material of the 1st layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) to the compound shown in Table 3 was produced.

[0228]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9201 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9201 to 100. A result is shown in Table 3.

[0229]

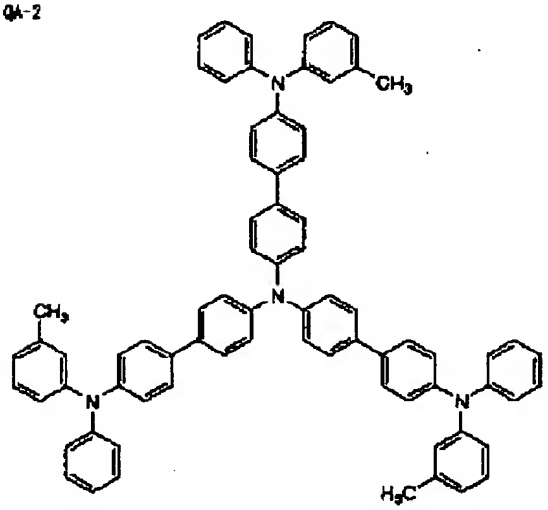
[Formula 63]

QA 1



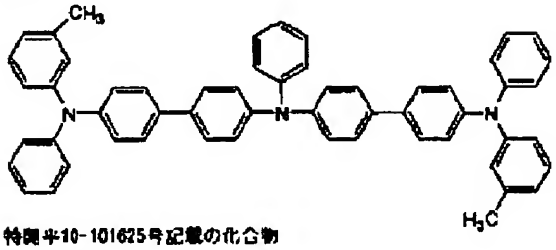
J.MATER.CHEM.,1992, 2(10),1109-1110記載の化合物

QA-2



特開平10-312073号記載の化合物

QA-3



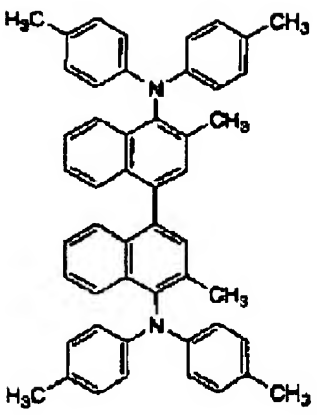
特開平10-101625号記載の化合物

[0230]

[0231]

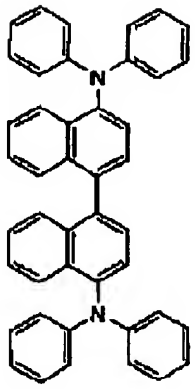
[Formula 64]

QA-4



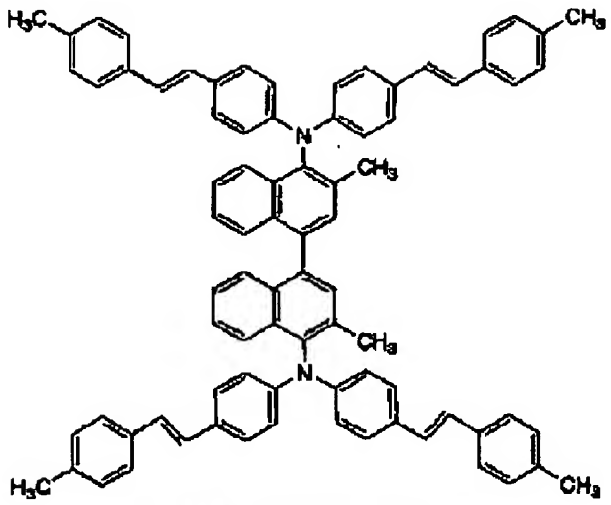
特開平11-152253号記載の化合物

QA-5



特開平11-152253号記載の化合物

QA-6



特開平11-152253号記載の化合物

[0232]

[Table 3]

No.	第1層の正孔輸送材料	発光輝度（相対値）	発色光	連続発光後の輝度半減時間（相対値）	備考
9200	NPB	124	青	77	比較例
9201	QA－1	100	青	100	比較例
9202	QA－2	103	青	112	比較例
9203	QA－3	97	青	87	比較例
9204	QA－4	95	青	110	比較例
9205	QA－5	90	青	103	比較例
9206	QA－6	87	青	108	比較例
9207	A－3	185	青	217	本発明
9208	A－5	181	青	256	本発明
9209	A－13	216	青	166	本発明
9210	A－6	190	青	201	本発明
9211	A－18	211	青	175	本発明
9212	A－19	237	青	211	本発明
9213	F－1	222	青	215	本発明
9214	F－12	210	青	201	本発明

clear from Table 3 — as — the doria of this invention — light emitting luminance is high and the luminescence life of an element also understands a long time for each sample (No.9207-9214) which uses a reel amine compound as a hole transporting material of an electroluminescent element again.

[0233]For example, by compound-A-3 of this invention which has three bond axes, it turns out that there are twice [about] as many light emitting luminance as this and a more than twice as many life as this to the sample (No.9201) which uses N,N,N-tri-p-terphenyl amine (QA-1).

[0234]three or more doria — to the sample (No.9202, 9203) using QA-2 and QA-3 which have a reel amine portion, three doria — it turned out that the light emitting luminance and the life of the direction of the sample (9209) which uses the compound (A-13) of this invention which has three C_2 axes of symmetry in intramolecular with a reel amine portion are high.

[0235]Similarly it compares with comparison compound-Q A-4 and QA-5 and QA-6 which are benzidine (naphthidine) derivatives, It turned out that high light emitting luminance and a long luminescence life are compatible in the electroluminescent element to which compound-A-6 of this invention, A-18, A-19, and F-1 used it for the electron hole transporting bed.

[0236]that is, the doria of this invention which has a beer reel group which has two or more ATOROPU bond axes in intramolecular — generally a reel amine compound, Compared with the compound which does not have a beer reel group with an ATOROPU bond axis, or it has only one piece, in the electroluminescent element which used it for the hole transporting material, an electron hole transportation function is high and, in the life, a long time became further clear from this result.

[0237]EXAMPLE (9-3) — doria — performance comparison (evaluation as a hole transporting material and luminescent material) of a reel amine compound

EXAMPLE (9-1) — and in creation of the electroluminescent element of (9-2), the organic electroluminescence (9300-9312) considered as the 1st layer (electron hole transporting bed and luminous layer) and 3rd-layer (electron transport layer) two-layer composition shown [way / similar] in Drawing 102 was produced except not vapor-depositing the 2nd layer (luminous layer).

[0238]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9301 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9301 to 100. A result is shown in Table 4.

[0239]

[Table 4]

No.	第1層の正孔輸送材料兼発光材料	発光輝度（相対値）	発色光	連続発光後の輝度半減時間（相対値）	備考
9300	NPB	63	青	82	比較例
9301	QA-1	100	青	100	比較例
9302	QA-2	15	青	95	比較例
9303	QA-3	58	青	82	比較例
9304	QA-4	89	青	108	比較例
9305	QA-5	72	青	93	比較例
9306	QA-6	211	青	90	比較例
9307	A-3	312	青	191	本発明
9308	A-5	256	青	209	本発明
9309	A-13	271	青	181	本発明
9310	A-6	288	青	200	本発明
9311	A-18	270	青	182	本発明
9312	A-19	279	青	218	本発明
9313	F-1	277	青	210	本発明
9314	F-12	245	青	232	本発明

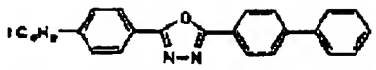
[0240]Table 4 shows — as — comparative doria — although it turns out that each reel amine compound (NPB and QA-1 - QA-6) becomes a hole transporting material and luminescent material, in any case, light emitting luminance is low short-life again.

[0241]the doria which has in intramolecular two or more beer reel groups which have an ATOROPU bond axis of this invention to it — in the electroluminescent element using a reel amine compound, it turned out that it may be compatible in high light emitting luminance and a long life.

[0242]

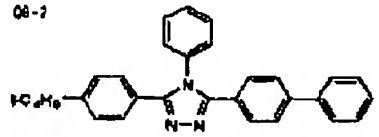
[Formula 65]

OB-1



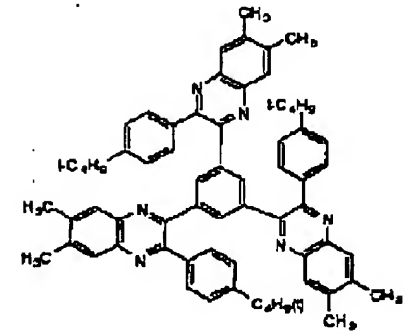
Appl.Phys Lett ,55,1489(1989)記載の化合物

OB-2



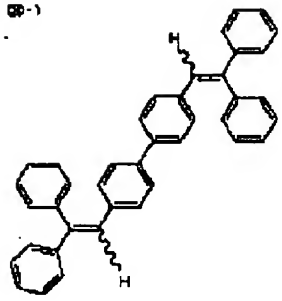
Jpn.J.Appl.Phys.,32,L917(1993)記載の化合物

OC-1



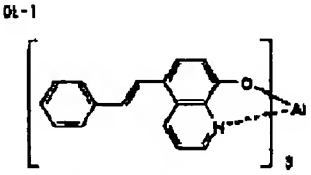
Macromolecules,31,8434(1998)記載の化合物

OD-1



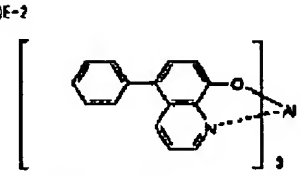
Appl Phys Lett ,67,3853(1995)記載の化合物

OE-1



特開平9-255680号記載の化合物

OE-2



特開平10-251489号記載の化合物

[0243]EXAMPLE (9-4) — performance comparison (evaluation as an electron transport material) of 5 member heterocyclic compound The electroluminescent element (9401-9411) which changed only OXD-7 which is an electron transport material of the 3rd layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) to the compound shown in Table 5 was produced.

[0244]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9401 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9401 to 100. A result is shown in Table 5.

[0245]

[Table 5]

No.	第3層の電子輸送材料	発光輝度（相対値）	発色光	連続発光後の輝度半減時間（相対値）	備考
9200	OXD−7	121	青	128	比較例（CF−1）
9401	QB−1	100	青	100	比較例
9402	QB−2	103	青	131	比較例
9403	B−3	144	青	417	本発明
9404	B−1	133	青	325	本発明
9405	B−7	149	青	401	本発明
9406	B−9	153	青	377	本発明
9407	B−2	134	青	445	本発明
9408	B−8	149	青	469	本発明
9409	B−6	138	青	481	本発明
9410	B−10	144	青	381	本発明
9411	F−3	133	青	447	本発明

[0246]The sample (No.9403-9411) which uses 5 member heterocyclic compound of this invention as an electron transport material of an electroluminescent element so that clearly from Table 5, As for all, improvement in light emitting luminance was accepted compared with the sample (9200, 9401, and 9402) produced using the conventional electron transport material. The luminescence life of an element has also been improved very greatly. Although such an effect (setting especially to the life of an element) is fully demonstrated also in 5 member heterocyclic compound (B-1, B-3, B-7, B-9, B-10) of this invention which has one beer reel group with an ATOROPU bond axis in intramolecular, The tendency for the effect to become more remarkable was also accepted in 5 member heterocyclic compound (B-2, B-8, B-6, F-3) of this invention which has a beer reel group which furthermore has two ATOROPU bond axes in intramolecular.

[0247]EXAMPLE (9-5) — performance comparison (evaluation as an electron transport material and luminescent material) of 5 member heterocyclic compound compound

In creation of the electroluminescent element of EXAMPLE (9-4), the organic electroluminescence (9500-9511) considered as the 1st layer (electron hole transporting bed) and 3rd-layer (electron transport layer and luminous layer) two-layer composition shown [way / similar] in Drawing 103 was produced except not vapor-depositing the 2nd layer (luminous layer).

[0248]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9501 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9501 to 100. A result is shown in Table 6.

[0249]

[Table 6]

No.	第3層の電子輸送材料兼発光材料	発光輝度（相対値）	発色光	連続発光後の輝度半減時間（相対値）	備考
9500	OXD−7	135	青	122	比較例
9501	QB−1	100	青	100	比較例
9502	QB−2	142	青	128	比較例
9503	B−3	312	青	369	本発明
9504	B−1	252	青	376	本発明
9505	B−7	388	青	321	本発明
9506	B−9	400	青	381	本発明
9507	B−2	501	青	401	本発明
9508	B−8	522	青	443	本発明
9509	B−6	477	青	450	本発明
9510	B−10	344	青	312	本発明
9511	F−3	479	青	405	本発明

[0250]The sample (No.9503-9511) which uses 5 member heterocyclic compound of this invention as an electron transport material and luminescent material of an electroluminescent element so that clearly from Table 6, As for all, compared with the sample (9500, 9501, and 9502) produced using the conventional electron transport material, the large improvement in light emitting luminance was accepted. The luminescence life of an element has also been improved very greatly. Although such an effect (setting especially to the life of an element) is fully demonstrated also in 5 member heterocyclic compound (B-1, B-3, B-7, B-9, B-10) of this invention which has one beer reel group with an ATOROPU bond axis in intramolecular, The tendency for the effect to become more remarkable was also accepted in 5 member heterocyclic compound (B-2, B-8, B-6, F-3) of this invention which has a beer reel group which furthermore has two ATOROPU bond axes in intramolecular.

[0251]EXAMPLE (9-6) — performance comparison (evaluation as an electron transport material) of 6 member heterocyclic compound

The electroluminescent element (9601-9605) which changed only OXD-7 which is an electron transport material of the 3rd layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) to the compound shown in Table 7 was produced.

[0252]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9601 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9601 to 100. A result is shown in Table 7.

[0253]

[Table 7]

No.	第3層の電子輸送材料	発光輝度(相対値)	発色光	連続発光後の輝度半減時間(相対値)	備考
9601	QC-1	100	青	100	比較例
9602	C-1	131	青	312	本発明
9603	C-2	185	青	283	本発明
9604	C-3	133	青	340	本発明
9605	C-8	167	青	401	本発明

[0254]As for all, compared with the sample (9601) which the sample (No.9602-9605) used as an electron transport material of an electroluminescent element produced using the conventional electron transport material, improvement in light emitting luminance was accepted in 6 member heterocyclic compound of this invention so that clearly from Table 7. It turned out that the luminescence life of an element is also improved very greatly.

[0255]EXAMPLE (9-7) — performance comparison (evaluation as an electron transport material and luminescent material) of 6 member heterocyclic compound compound

The 2nd layer (luminous layer) of the electroluminescent element (9601-9605) produced by EXAMPLE (9-6) was removed, and the organic electroluminescence (9701-9705) considered as the 1st layer (electron hole transportation) and 3rd-layer (electron transport layer layer and luminous layer) two-layer composition was produced. The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9701 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9701 to 100. A result is shown in Table 8.

[0256]

[Table 8]

No.	第3層の電子輸送材料兼発光材料	発光輝度(相対値)	発色光	連続発光後の輝度半減時間(相対値)	備考
9701	QC-1	100	青	100	比較例
9702	C-1	140	青	280	本発明
9703	C-2	209	青	221	本発明
9704	C-3	139	青	321	本発明
9705	C-8	205	青	310	本発明

[0257]The sample (No.9702-9705) which uses 6 member heterocyclic compound of this invention as an electron transport material and luminescent material of an electroluminescent element so that clearly from Table 8, As for all, compared with the sample (9701) produced using the conventional electron transport material, the large improvement in light emitting luminance was accepted. It turned out that the luminescence life of an element is also improved very greatly.

[0258]EXAMPLE (9-8) — the compound C-9 of example this invention of use of others of 6 member heterocyclic compound compound as a fluorescence dopant, Compared with conventional Quinacridone and N,N'-dimethyl Quinacridone (DMQA), it turned out that high light emitting luminance and a long life are attained by concomitant use with luminescent materials, such as Alq_3.

[0259]In the compound C-6 of this invention, it turned out that it becomes a luminescent material which emits light to yellowish green.

[0260]EXAMPLE (9-9) — performance comparison (evaluation as a luminescent material) of a stilbene compound

The electroluminescent element (9901-9908) which changed only Zn(BOX) 2 which is a luminescent material of the 2nd layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) to the compound shown in Table 9 was produced.

[0261]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9901 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9901 to 100. A result is shown in Table 9.

[0262]

[Table 9]

No.	第2層の発光材料	発光輝度(相対値)	発色光	連続発光後の輝度半減時間(相対値)	備考
9901	QD−1	100	青	100	比較例
9902	D−1	122	青	140	本発明
9903	D−5	125	青	134	本発明
9904	D−8	131	青	142	本発明
9905	D−12	140	青	125	本発明
9906	D−11	158	青	155	本発明
9907	D−2	205	青	212	本発明
9908	D−4	212	青	209	本発明

[0263]As for all, compared with the sample (9901) which the sample (No.9902-9908) used as a luminescent material of an electroluminescent element produced using the conventional luminescent material, improvement in light emitting luminance was accepted in 5 member heterocyclic stilbene compound of this invention so that clearly from Table 9. The luminescence life of an element has also been improved greatly. Although such an effect is fully demonstrated also in the stilbene compound (D-1, D-5, D-8, D-11, D-12) of this invention which has one beer reel group with an ATOROPU bond axis in intramolecular, The tendency for the effect to become more remarkable was also accepted in the stilbene compound (D-2, D-4) of this invention which has a beer reel group which furthermore has two ATOROPU bond axes in intramolecular.

[0264]EXAMPLE (9-10) — performance comparison (evaluation as an electron transport material and luminescent material) of a metal complex system compound

Zn(BOX) 2 which is a luminescent material of the 2nd layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) is changed to the compound shown in Table 10, The electroluminescent element (91001-91008) of the two-layer composition of the electron hole transporting bed (the 1st layer) which removed the electron transport layer of the 3rd [further] layer, and an electron transport layer and luminous layer (the 2nd layer) was produced.

[0265]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the luminous efficiency (lm/W) at the time of a lighting start and luminosity was measured. Luminous efficiency was expressed with the relative value when luminous efficiency of sample No.91001 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.91001 to 100. A result is shown in Table 10.

[0266]

[Table 10]

No.	第2層の電子輸送材料兼発光材料	発光輝度(相対値)	発色光	連続発光後の輝度半減時間(相対値)	備考
91001	QE−1	100	オレンジ	100	比較例
91002	QE−2	140	黄	150	比較例
91003	E−1	312	黄緑	329	本発明
91004	E−6	421	黄緑	411	本発明
91005	E−7	235	黄	307	本発明
91006	E−10	329	黄緑	311	本発明
91007	E−11	544	緑	289	本発明
91008	F−5	551	黄緑	423	本発明

[0267]The sample (No.91003-91007) which uses the metal complex system compound of this invention as an electron transport material and luminescent material of an electroluminescent element so that clearly from Table 10, Compared with the sample (91001 and 91002) produced using the conventional material, luminous efficiency was fitness (since a luminous wavelength was not able to compare with difference light emitting luminance greatly, comparison with luminous efficiency was performed) in each case. It turned out that the luminescence life of an element is also improved greatly.

[0268]2-aryl phenylpyridine derivative expressed with the general formula (N1) of typical synthesizing method this invention of the compound of this invention, It is compoundable by Shuichi Oi, Susumu Fukita and Yoshiolnoue Chem.Comumun., 1998, and the method indicated to 2439-2440.

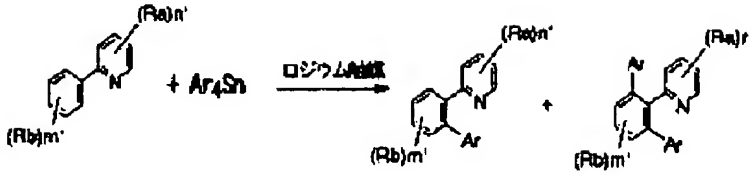
[0269]In addition, typically, composition of various compounds which have a binaphthyl group of this invention is compoundable by a synthetic pathway as shown in the scheme 2 - the scheme 5.

[0270]next, the doria of this invention by the course shown by the scheme 4 as the example of representation — the synthetic example of reel amine (A-18) is shown.

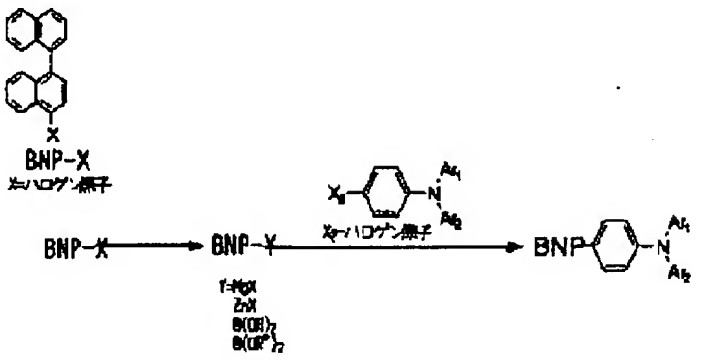
[0271]

[Formula 66]

スキーム1



スキーム2



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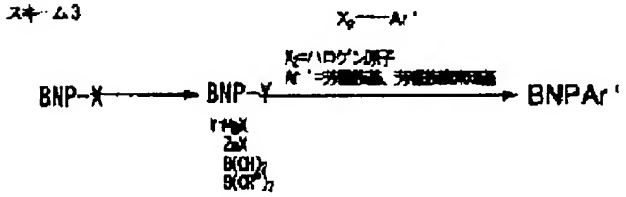
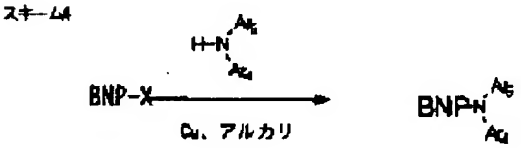
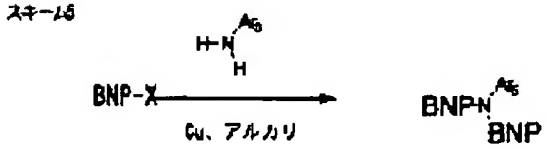


スキーム4



スキーム5



[0272][The synthetic example 1]

The 4-bromo- 1, 1'-binaphthyl Composition of [the compound XX]: The solution which dissolved 50 g (197mmol) of 1,1'-binaphthyl in 600 ml of methylene chlorides within a 2000-ml 4 mouth flask, and diluted 3.4 ml (65.6 mol, 1/3 Eq) of bromine with the methylene chloride 10 times in the ice bath was dropped. It added the bromine solution 2 times at a time 1/3-Eq further, having sampled the solution after the end of dropping and checking conversion with high performance chromatography. After agitating at a room temperature after that one whole day and night, it distilled off under decompression of a solvent. The 4-bromo- 1 and 43.9 g (67.0%) of 1'-binaphthyl were obtained by performing recrystallization for the obtained rough product from acetonitrile, and performing suspension washing twice with methanol further.

[The synthetic example 2]

Composition of N,N'-diphenyl-N,N'-binaphthyl benzidine [compound-A-18] : In a 500-ml 3 Thu mouth flask, the 4-bromo- 1 and 10 g (30.0mmol) of 1'-binaphthyl, 4.73 g (34.2mmol) and 25 ml of nitrobenzene were put in for 0.48 g (7.50mmol) and potassium carbonate, and 5.05 g (15.0mmol) of N,N'-diphenylbenzidine and copper powder were agitated at 200 ** for 30 hours. Toluene after ending reaction was added, it filtered, and the inorganic substance was removed. Subsequently, rinse a filtrate, dry with magnesium sulfate and a solvent is distilled off, 5.40 g of N,N'-diphenyl-N,N'-binaphthyl benzidine was obtained by carrying out separation refinement with the silica gel column chromatography using a toluene-hexane mixed solvent (65.0mmol, 43.0%).

[0273]

[Effect of the Invention]As the 1st effect of this invention, the color conversion filter using the rare earth metal complex configurated by the particle inorganic fluorescent substance or organic ligand of this invention was able to be obtained, As the 2nd effect, with the combination of the color conversion filter of this invention, and a publicly known near-ultraviolet luminescence organic electroluminescence element. As that it has checked that a luminous wavelength was convertible for visible light, and the 3rd effect, With combination with the organic electroluminescence element using the compound of this invention which emits light to the color conversion filter of this invention, near-ultraviolet [of this invention], or a purple field. Good visible luminescence could be checked and a long time found the luminescence life, it is mentioned that it has checked that high light emitting luminance or luminous efficiency, and a long luminescence life were compatible in the organic electroluminescence element using the compound of this invention which has a beer reel group with which the bond axis which can give internal rotation opposite-sex nature as the 4th effect exists.

[Translation done.]

TECHNICAL FIELD

[Industrial Application]This invention about an electroluminescent element specifically, It is related with the electroluminescent element used suitably [emitted-light type multicolor or a full color display, a display panel, etc.] for the display equipment of a noncommercial use or industrial use, a color image formation method, and a light filter.

[Translation done.]

PRIOR ART

[Description of the Prior Art]There are emitted type of light and received type of light in an electronic display device, and CRT (cathode-ray tube), PDP (plasma display), ELD (electroluminescence display), VFD (fluorescent display), etc. are mentioned as emitted type of light, for example.
[0003]ELD is explained in this.
[0004]With ELD (electroluminescence display). Two or more light emitting devices which consist of material which emits light by the electric field or an electric field, or they are combined, and there are a career pouring type with which organicity and inorganic matter used the recombination of an electron and an electron hole, and an acceleration electron type using the collision energy of the acceleration electron as luminescent mechanism further as a material. While it is longer-life than organicity and inorganic matter is generally more stable in material, the developed width of material is narrow and a molecular design has restriction. Generally there is an advantage [direction / of a recombined type] that driver voltage is lower than an acceleration electron type, mechanistically, and career pouring type ELD is briskly studied from the advantage in recent years.
[0005]As an ELD material, there are specifically the following three kinds.
[0006]** Inorganic LED (material comprises inorganic compounds, such as GaN and GaInN, and luminescent mechanism is a recombined type.) It is only referred to also as LED (light emitting diode).
** Organic LED (doria material comprising organic compounds, such as a reel amine derivative and a stilbene derivative, luminescent mechanism recombined type.) It is referred to also as organic electroluminescence (electroluminescent element) and OLED.
** Inorganic EL (material comprises inorganic compounds, such as ZnS:Mn and ZnS:Tb, and luminescent mechanism is an acceleration electron type.) Rather than organic electroluminescence D, since history is old, it may only be called electroluminescence (EL) here.
In this, the "electroluminescent elements" said by this invention is ** and **, and "electroluminescence material" shows the thing of the material which constitutes ** and **. Therefore, the above-mentioned ** is excepted from this invention.
[0007]Since the thin film which consists of organic compounds comes to be used for the career pouring type organic electroluminescence element which attracts attention especially in recent years, what has large luminescence intensity has come to be obtained. For example, the thing which used single crystal anthracene etc. for U.S. Pat. No. 3,530,325 as a photogen, What combined the hole injection layer and the organic luminous body layer with JP,59-194393,A, What combined the hole injection layer and the organic electron injection transporting bed with JP,63-295695,A, Jpn.Journal of Applied Phisycs, vol127, and No.2 — what combined the electron hole moving bed, the luminous layer, and the electronic transition layer with the 269-271st page is indicated, respectively, and luminescence intensity has been improved by these.
[0008]******** which absorbs luminescence of the above-mentioned electroluminescence material and makes fluorescence emit light on the other hand is known. About the method of making multicolor fluorescence emitting light from a certain electroluminescence material, it is applied to CRT, PDP, VFD, etc. using this fluorescent substance. However, it is high in energy, namely, that a luminous wavelength is short wave poses a problem — there is luminescence of electroluminescence material by the electron beam or a far ultraviolet ray in this case. That is, although the above-mentioned fluorescent substance is specifically an inorganic fluorescent substance and many things which can be very highly [about stability] equal to long-term use are also known, The actual condition was that there is almost nothing that excited wavelengths excite to the long wavelength of calling it a visible region from near-ultraviolet, in an inorganic fluorescent substance, and there is. [that emits light especially in red light]
[0009]Although it is presumed that the near ultraviolet ray with possible making light emit from electroluminescence material is light with a maximum luminous wavelength of about 350 nm - about 400 nm, Using organic fluorescent dye as a fluorescent substance excited by such a near ultraviolet ray is known for JP,3-152897,A, 9-245511, 5-258860, etc.
[0010]However, generally, organic fluorescent dye tends to receive influence in the surrounding environment, and according to for example, the kind of media, such as a solvent and resin, etc. The fluorescence wavelength may change (discoloration), or optical quenching may be started, it is very more unstable still to light or heat, for example, under an about 100,000 luxs strong light, it is most which is decomposed from several minutes in about several hours, and the organic fluorescent dye which can be equal to a mothball does not exist.
[0011]The blue fluorochrome of a photogen which is, carries out, absorbs the light of a blue-green field, and carries out convert colors to a green field or a red region is used for the method indicated to said patent.
The fluorescence conversion film which shows a fluorescence of green regions has a small Stokes shift (difference of an absorption wavelength and a luminous wavelength), and it ends, And although it has the feature that it is possible to make a part of luminescence of electroluminescence material penetrate, it is comparatively efficient, and the light of a photogen can be changed, the fluorescence to a red spectrum region, Since a big Stokes shift is needed and also light of a photogen can hardly be used, conversion efficiency is remarkably low.
Optical - light conversion (photoluminescence) of two or more fluorochromes needed to be used for other stages like the fluorochrome which uses together the fluorochrome from which several kinds of excited wavelengths specifically differ, for example, becomes yellow in response to blue glow, and the fluorochrome which shines in red in response to yellow, and efficient[on a principle]-izing was impossible.
[0012]therefore, in a Prior art, there were problems also including the problem of previous discoloration, brightness lowering, and optical quenching that the balance of blue and green and red light emitting luminance is bad, and red luminosity could not

but be low and could not but become a low-intensity colored presentation with visibility bad on the whole especially.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]As the 1st effect of this invention, the color conversion filter using the rare earth metal complex configurated by the particle inorganic fluorescent substance or organic ligand of this invention was able to be obtained, As the 2nd effect, with the combination of the color conversion filter of this invention, and a publicly known near-ultraviolet luminescence organic electroluminescence element. As that it has checked that a luminous wavelength was convertible for visible light, and the 3rd effect, With combination with the organic electroluminescence element using the compound of this invention which emits light to the color conversion filter of this invention, near-ultraviolet [of this invention], or a purple field. Good visible luminescence could be checked and a long time found the luminescence life, it is mentioned that it has checked that high light emitting luminance or luminous efficiency, and a long luminescence life were compatible in the organic electroluminescence element using the compound of this invention which has a beer reel group with which the bond axis which can give internal rotation opposite-sex nature as the 4th effect exists.

[Translation done.]

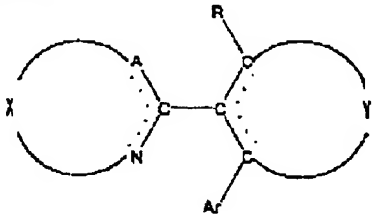
TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Wholeheartedly, as a result of examination, by using an inorganic system fluorescent substance and/or a rare earth complex system fluorescent substance, this invention persons were high-intensity, and come to get a highly preservable electroluminescent element, and came to provide the light filter with high luminosity by application of this electroluminescent element.

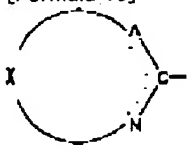
[Translation done.]

MEANS

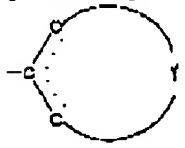
[Means for Solving the Problem]This invention persons found out that the above-mentioned purpose could be attained with the following composition, as a result of stepping up efforts wholeheartedly.
(1) Electroluminescence material characterized by what is expressed with a following general formula (N1), [0015]
[Formula 14]
一般式（Ｎ１）



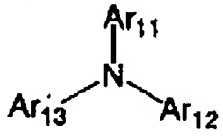
[0016][Ar expresses an aryl group among a formula and A expresses a carbon atom, a nitrogen atom, a sulfur atom, or an oxygen atom, X expresses an atomic group required to form the nitrogen-containing aromatic heterocycle of 5 members or 6 members with A and N, Y expresses an atomic group required to form the aromatic hydrocarbon rings or the aromatic heterocycle of 5 members or 6 members with three carbon atoms, the C-N combination in a formula, C-A combination, and C-C combination express a single bond or a double bond, and R expresses a hydrogen atom, a substituent, or Ar. Further
[0017]
[Formula 15]



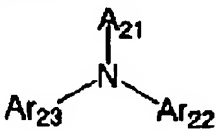
[0018]the nitrogen-containing aromatic heterocycle come out of and expressed — and [0019]
[Formula 16]



[0020]It could come out and the aromatic hydrocarbon rings or the aromatic heterocycle expressed may be further condensed according to a hydrocarbon ring or heterocycle.]
(2) Electroluminescence material characterized by what is expressed with a following general formula (A1), [0021]
[Formula 17]
一般式（Ａ１）

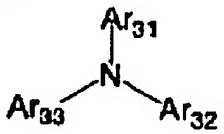


[0022][A beer reel group with a bond axis which can give at least two internal rotation opposite-sex nature exists in intramolecular of a compound which Ar_{11}, Ar_{12}, and Ar_{13} express an aryl group or an aromatic heterocycle group, and is expressed with a general formula (A1) among a formula.]
(3) The electroluminescence material according to claim 2 characterized by what is expressed with a following general formula (A2), [0023]
[Formula 18]
一般式（Ａ２）

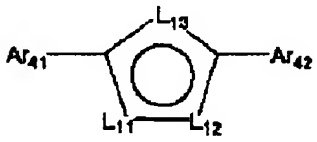


[0024][Ar_{21}, Ar_{22}, and Ar_{23} express among a formula the beer reel which has a bond axis which can give internal rotation

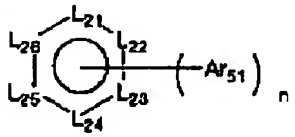
opposite-sex nature independently, respectively.]
(4) Electroluminescence material given in claim 2 or any of 3 they are. [which is characterized by what is expressed with a following general formula (A3)]
[0025]
[Formula 19]
一般式 (A 3)



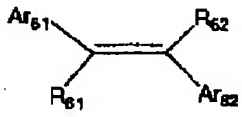
[0026]Ar_{31}, Ar_{32}, and Ar_{33} express an aryl group or an aromatic heterocycle group independently among [type, respectively — and inside of Ar_{31}, Ar_{32}, and Ar_{33} — at least two — 1 and 1' — an aryl group which has - binaphthyl group is expressed.]
(5) Electroluminescence material characterized by what is expressed with a following general formula (B1), [0027]
[Formula 20]
一般式 (B 1)



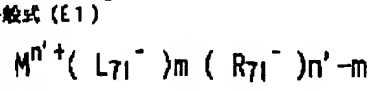
[0028][Ar_{41} and Ar_{42} express an aryl group or an aromatic heterocycle group independently among a formula, respectively, L_{11}, L_{12}, and L_{13} express an atomic group required to form the aromatic heterocycle of 5 members, At least one of L_{11}, L_{12}, and L_{13} expresses =N-, $-N(R_{41})-$, -S-, or -O-, and R_{41} expresses a hydrogen atom or a substituent. However, at least one of Ar_{41}, Ar_{42}, and R_{41} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]
(6) Electroluminescence material characterized by what is expressed with a following general formula (C1).
[0029]
[Formula 21]
一般式 (C 1)



[0030][Ar_{51} expresses an aryl group or an aromatic heterocycle group among a formula, n expresses the integer of 0 to 6, and when n is two or more, two or more Ar_{51} may be the same, or may differ, L_{21}, L_{22}, L_{23}, L_{24}, L_{25} and L_{26} express an atomic group required to form the nitrogen-containing aromatic heterocycle of 6 members, At least one of L_{21}, L_{22}, L_{23}, L_{24}, L_{25}, and L_{26} expresses =N- or $-N(R_{51})-$, and R_{51} expresses a hydrogen atom or a substituent. However, at least one of Ar_{51} and R_{51} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]
(7) Electroluminescence material characterized by what is expressed with a following general formula (D1), [0031]
[Formula 22]
一般式 (D 1)



[0032][Ar_{61} and Ar_{62} express an aryl group or an aromatic heterocycle group among a formula, and R_{61} and R_{62} express a hydrogen atom or a substituent. However, at least one of Ar_{61}, Ar_{62}, R_{61}, and R_{62} is a basis which has a beer reel group with the bond axis which can give internal rotation opposite-sex nature, or its portion. Adjoining substituents are condensed mutually and they may form the ring of saturation or an unsaturation.]
(8) Electroluminescence material characterized by what is expressed with a following general formula (E1), [0033]
[Formula 23]
一般式 (E 1)



$$M^{n'+}(L_{71}^{-})_m(R_{71}^{-})_{n'-m}$$

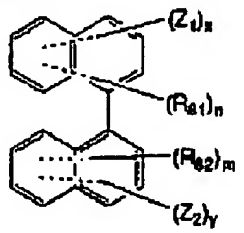
[0034][M expresses among a formula a metallic element which can take an ionic state to tetravalence from univalent, n' expresses a natural number of 1 to 4, and L_{71}^{-} forms M and an ionic bond, And a univalent anion which has a portion which

can be configurated in M is expressed, m is the same as n', or expresses a natural number smaller than it, and R_{71}^- expresses a univalent anion which forms M and an ionic bond. However, at least one of L_{71}^- or the R_{71}^- is a basis which has a beer reel portion with a bond axis which can give internal rotation opposite-sex nature.]

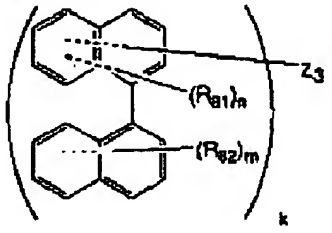
(9) Electroluminescence material characterized by what is expressed with a following general formula (F1) or (F2), [0035]

[Formula 24]

一般式 (F 1)



一般式 (F 2)

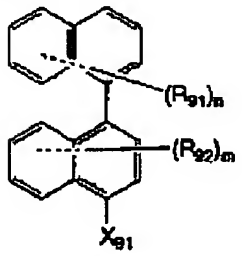


[0036][Z_1 and Z_2 among a formula, Express luminescent univalent compound residue independently, respectively, and Z_3 expresses the luminescent compound residue of k value, k expresses the natural number of 1-8, x expresses the natural number of 1-3, and y expresses the integer of 0-3, When x is two or more, two or more Z_1 may be the same, or it may differ, when y is two or more, two or more Z_2 may be the same, or it may differ, and when both x and y are one or more further, Z_2 may be the same as Z_1, or may differ from each other. R_{81} and R_{82} express a substituent independently, respectively, n expresses the integer of 0-4, m expresses the integer of 0-4, and when n is two or more, two or more R_{81} may be the same, or may differ, It condenses mutually and a ring may be formed, when m is two or more, two or more R_{82} may be the same, or it may differ, and it condenses mutually and a ring may be formed, and when both n and m are one or more further, R_{82} may be the same as R_{81}, or may differ from each other. Each substituent of Z_1, Z_2, R_{81}, and R_{82} may form a naphthalene ring and a condensed ring.]

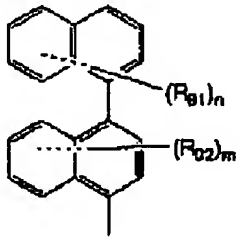
(10) A compound for organic electroluminescence having a univalent beer reel group which uses for a raw material the 4-halo 1 expressed with a following general formula (G1), and a 1'-binaphthyl derivative, and is expressed with a following general formula (G2) they to be [any of intramolecular], [0037]

[Formula 25]

一般式 (G 1)



一般式 (G 2)



[0038][X_{91} expresses a halogen atom among a formula, and R_{91} and R_{92} express a substituent independently, respectively, When n expresses the integer of 0-4, m expresses the integer of 0-4 and n is two or more, Two or more R_{91} may be the same, may differ, and is condensed mutually, and may form a ring, When m is two or more, two or more R_{92} may be the same, or it may differ, and it condenses mutually and a ring may be formed, and when both n and m are one or more further, R_{92} may be the same as R_{91}, or may differ from each other.]

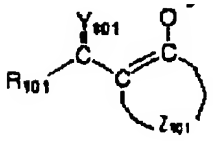
(11) An inorganic system fluorescent substance which emits light to a different maximum luminous wavelength from a maximum luminous wavelength which absorbs at least one sort of erection loss MINESSENSU material, and luminescence of this electroluminescence material, and is emitted from this electroluminescence material. An electroluminescent element containing at least one sort, (12) The electroluminescent element according to claim 11, wherein said inorganic system fluorescent substance is an inorganic system fluorescent substance manufactured by the Sol-Gel method, (13) The electroluminescent element according to claim 11 or 12, wherein a maximum luminous wavelength of said inorganic system fluorescent substance is 400-700 nm, (14) An electroluminescent element given in any 1 paragraph of claims 11-13 to which at least one sort of said inorganic system photogen is characterized by a maximum luminous wavelength being 600-700 nm, (15) An electroluminescent element containing a rare earth complex system fluorescent substance which emits light to a different maximum luminous wavelength from a maximum luminous wavelength which absorbs luminescence of erection loss MINESSENSU material and this electroluminescence material, and is emitted from this electroluminescence material, (16) The electroluminescent element according to claim 15, wherein a maximum luminous wavelength of said rare earth complex system fluorescent substance is 400-700 nm, (17) An electroluminescent element given in claim 15 to which at least one sort of said rare earth complex system photogen is characterized by a maximum luminous wavelength being 600-700 nm, or any 1 paragraph of 16, (18) An electroluminescent element given in any 1 paragraph of claims 11-17, wherein a maximum luminous wavelength of said electroluminescence material is 430 nm or less, (19) The electroluminescent element according to claim 18, wherein a maximum luminous wavelength of said electroluminescence material is 400-430 nm, (20) An electroluminescent element given in any 1 paragraph of claims 11-19, wherein said electroluminescence material is organic LED, (21) an electroluminescent element given in any 1 paragraph of claims 11-19, wherein said electroluminescence material is inorganic LED, and (22) — said electroluminescence material — said general formula (N1), (A1), (A2), (A3), and (B1). The electroluminescent element according to claim 11 to 21 being at least one sort chosen from a compound expressed with (C1), (D1), (E1), (F1), (F2), (G1), or (G2), (23) At least one sort of an inorganic system fluorescent substance

which absorbs light emitted from a layer and this electroluminescence material which contain electroluminescence material on a base, and has a maximum luminous wavelength in 400–500 nm, On an electroluminescent element having a color conversion layer containing at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm, and (24) bases, At least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from a layer and this electroluminescence material containing electroluminescence material, and has a maximum luminous wavelength in 400–500 nm, An electroluminescent element having a color conversion layer containing at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm, (25) A color conversion filter containing at least one sort of an inorganic system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–700 nm, (26) At least one sort of an inorganic system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–500 nm, A color conversion filter containing at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm, (27) A color conversion filter given in claim 25, wherein said inorganic fluorescent substance is an inorganic system fluorescent substance manufactured by the Sol–Gel method, or any 1 paragraph of 26, (28) A color conversion filter containing at least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–700 nm, (29) At least one sort of a rare earth complex system fluorescent substance which absorbs light emitted from electroluminescence material and has a maximum luminous wavelength in 400–500 nm, A color conversion filter having a color conversion layer containing at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in at least one sort of a rare earth complex system fluorescent substance which has a maximum luminous wavelength in 501–600 nm, and 601–700 nm, (30) A color conversion method changing light of a short wavelength region into red rather than red using an inorganic system fluorescent substance manufactured by the Sol–Gel method, (31) A color conversion method changing light of a short wavelength region into red rather than red using a rare earth complex system fluorescent substance, (32) A rare earth complex system fluorescent substance having the color conversion method according to claim 31, wherein absorption maximum wavelength of said rare earth complex system fluorescent substance is not less than 340 nm, and at least one anionic ligand expressed with (33) following general formulas (R2).

[0039]

[Formula 26]

一般式（Ｒ２）



[0040][R_{101} expresses a hydrogen atom or a substituent among a formula, and Y_{101} An oxygen atom, A sulfur atom or –N(R_{102})– is expressed, R_{102} expresses a hydrogen atom or a substituent, and Z_{101} expresses an atomic group required to form four to 8 membered–ring with the double bond of carbon and carbon.]

This invention is explained in detail below.

[0041]In this invention, with electroluminescence material. It is the material which emits light by the electric field or an electric field, and from the anode and the negative pole, an electron hole and an electron are poured in, respectively, and it is the material which emits light when [in which they recombine] carrying out, and specifically differs from the material by the collision energy of an acceleration electron which emits light (what is called inorganic electroluminescence).

[0042]On both sides of a luminous layer, it has a counterelectrode of a couple as emitting light by the electric field or an electric field, and the electroluminescence material contained in this luminous layer by sending current through this electrode emits light. The electron poured in from one electrode of the counterelectrode of a couple in which this sandwiched the luminous layer, Recombination happens within a luminous layer by the electron hole poured in from another electrode, When electroluminescence material is excited by the higher energy level and the excited electroluminescence material returns to the original ground state, it is thought that it happens by releasing energy as a light.

[0043]Electroluminescence material used for this invention, As long as it emits light by electric field or an electric field, there may not be any restriction in particular, for example, an inorganic electroluminescence material (it is also called inorganic LED) like gallium nitride (GaN) may be sufficient, Although you may be any of an organic electroluminescence material (it is also called organic LED), it is preferred from a point of luminous efficiency to use organic LED.

[0044]In this invention, as for electroluminescence material, it is preferred that it is what has a maximum luminous wavelength in 430 nm or less by electric field or an electric field, and also it is preferred that it is what has a maximum luminous wavelength in 400–430 nm.

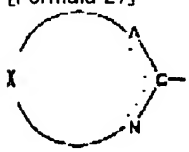
[0045]On a CIE chromaticity diagram table, it is the 4th ** of a new edition color science handbook. Edited by Color Science Association of Japan Inside of "relation between a color name of drawing 4 .16 color stimulus (color of light), and a chromaticity coordinate" indicated to the 108th page Purplish Blue, It is preferred that it is a field of Blueish Purple or Purple.

[0046]Electroluminescence material preferably used for this invention is explained concretely.

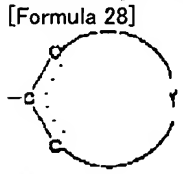
[0047]Electroluminescence material preferably used for this invention, The aforementioned general formula (N1), (A1), (A2), (A3), (B1), the 4–halo 1 expressed with a compound expressed with (C1), (D1), (E1), (F1), and (F2), and (G1), and a 1'–binaphthyl derivative — as a raw material — using (G2) — a compound which has a univalent beer reel group with which it is expressed in either of the intramoleculars is raised.

[0048]In a general formula (N1), (A1), (A2), (A3), (B1), (C1), and (D1), Ar, Ar_{11}, Ar_{12}, Ar_{13}, Ar_{21}, Ar_{22}, Ar_{23}, Ar_{31}, Ar_{32}, As long as the number of pi electrons of an aryl group expressed with Ar_{33}, Ar_{41}, Ar_{42}, Ar_{51}, Ar_{61}, and Ar_{62} is 4n+2 (n is a

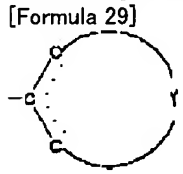
natural number), there may not be any restriction in particular and a monocycle or a condensed ring may be sufficient. Furthermore, by a substituent, this aryl group may be replaced and as the substituent which may be replaced, An alkyl group, a cycloalkyl group, an alkenyl group, an alkynyl group, an aryl group, A heterocycle group, an amino group, a halogen atom, a hydroxyl group, a sulfhydryl group, a carboxyl group, the acylamino group, a sulfonamide group, a HOSUHON amide group, a carbamoyl group, an ester group, an alkoxy group, an aryloxy group, a nitro group, a cyano group, a silyl group, etc. are mentioned. When two or more substituents replace by a place where this aryl group adjoins mutually, it may condense mutually, a hydrocarbon ring or heterocycle may be formed, and there may be a portion which has spiro structure further.
[0049]In a general formula (N1), (A1), (A2), (A3), (B1), (C1), and (D1), Ar, Ar_{11}, Ar_{12}, Ar_{13}, Ar_{21}, Ar_{22}, Ar_{23}, Ar_{31}, Ar_{32}, With an aromatic heterocycle group expressed with Ar_{33}, Ar_{41}, Ar_{42}, Ar_{51}, Ar_{61}, and Ar_{62}. The number of pi electrons expresses what removed one hydrogen atom from arbitrary positions of a heterocyclic compound of a monocycle which is 4n+2 (n is a natural number), or a condensed ring, For example, as a heterocyclic compound applicable to it, A franc, a thiophene, pyrrole, imidazole, a pyrazole, 1,2,4-triazole, 1,2,3-triazole, oxazol, a thiazole, an isoxazole, isothiazole, furazan, pyridine, pyrazine, pyrimidine, pyridazine, 1,3,5-triazine, etc. are mentioned, and these heterocycles may form a condensed ring further.
[0050]In a general formula (B1), (C1), (D1), (E1), (F1), (F2), (G1), and (G2), R_{41}, R_{51}, R_{61}, R_{62}, As a substituent expressed with R_{71}, R_{81}, R_{82}, R_{91}, and R_{92}, If replaceable, there will be no restriction in particular, but typically An alkyl group, a cycloalkyl group, An alkenyl group, an alkynyl group, an aryl group, a heterocycle group, an amino group, a halogen atom, A hydroxyl group, a sulfhydryl group, a carboxyl group, the acylamino group, a sulfonamide group, a HOSUHON amide group, a carbamoyl group, an ester group, an alkoxy group, an aryloxy group, a nitro group, a cyano group, a silyl group, etc. are mentioned. When two or more substituents replace by a place which adjoins mutually in this substituent, it may condense mutually, a hydrocarbon ring or heterocycle may be formed, and there may be a portion which has spiro structure further.
[0051]In a general formula (N1), [0052]
[Formula 27]



[0053]Come out, and as a nitrogen-containing heterocycle group expressed, the aromatic heterocycle of a 6pi system of 5 members or 6 members is preferred, and specifically, 2-pyridyl group, 2-pyrimidyl group, 6-pyrimidyl group, 2-pyrazyl group, 3-pyridazyl group, 2-oxazolyl group, 2-thiazolyl group, 3-isoxazolyl group, A 3-isothiazolyl group, 3-furazanyl group, 3-pyrazolyl group, 2-imidazolyl group, 4-imidazolyl group, 2-pyrrolo group, 2-oxadiazolyl group, 2-thiadiazolyl group, 2-(1, 2, 4-triazoryl) basis, 2-(1, 3, 5-triazyl) basis, 3-(1, 2, 4-triazyl) basis, etc. are mentioned. Furthermore, this nitrogen-containing heterocycle may be replaced by the substituent explained for example, by R_{41}, Furthermore, condensed rings (for example, 6-(1H-pyrazolo [5 and 1-c], and [1, 2, 4] triazoryl) basis etc. which made 2-quinolyl group and 3-pyrazolyl group which made 2-pyridyl group condense a hydrocarbon ring condense heterocycle) may be formed.
[0054]In a general formula (N1), [0055]
[Formula 28]



[0056]Come out and the aromatic-hydrocarbon-rings group with which it is expressed removes one hydrogen atom of arbitrary positions from the aromatic hydrocarbon compound of a 4n+2pi system, Specifically, a phenyl group, 1-naphthyl group, 2-naphthyl group, 9-anthryl group, 1-anthryl group, 9-phenan tolyl group, 2-TORIFENIRENIRU group, 3-peri RENIRU group, etc. are mentioned. Furthermore, this hydrocarbon ring may be replaced by the substituent explained for example, by R_{41}, and may form further condensed rings (for example, 9-pyrenyl group which made 9-phenan tolyl group condense a hydrocarbon ring, 8-quinolyl group which made the phenyl group condense heterocycle, etc.).
[0057]In a general formula (N1), [0058]
[Formula 29]

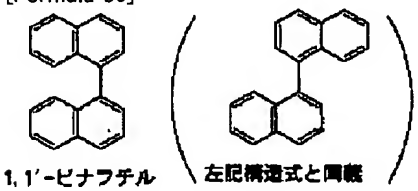


[0059]If at least both contiguity of a portion combined with a nitrogen-containing aromatic heterocycle is carbon atoms and an aromatic heterocycle group expressed is an aromatic group of a 4n+2pi system, will come out, and there will be no restriction in particular, and specifically, 3-pyridyl group, 5-pyrimidyl group, 4-pyridazyl group, 5-pyridazyl group, 4-isoxazolyl group, a 4-isothiazolyl group, 4-pyrazolyl group, 3-pyrrolo group, 3-furil group, 3-thienyl group, etc. are mentioned. Furthermore, this heterocycle may be replaced by substituent explained for example, by R_{41}, and may form a condensed ring further.
[0060]With "a bond axis which can give internal rotation opposite-sex nature" indicated to a general formula (A1), (A2), (B1), (C1), (D1), (E1), (F1), and (F2). For example, like a bond axis which connects a naphthalene nucleus and a naphthalene nucleus of the following 1 and 1'-binaphthyl, A bond axis which cannot perform 360 free rotation according to steric exclusion under ordinary temperature ordinary pressure is meant, and if 360 free rotation cannot be performed when a CPK model is constructed for convenience, it can be said that the bond axis is "a bond axis which can give internal rotation opposite-sex nature."

[0061]Although an isomer exists in a compound which has "a bond axis which can give internal rotation opposite-sex nature" and the isomer is called an "atropisomer" or "internal rotation optical isomer" (chemicals great dictionary volume [6th] 588th page KYORITSU SHUPPAN), Conversely, if it says, with a compound (or substituent) with "a bond axis which can give internal rotation opposite-sex nature", it can also be put in another way as a compound (or substituent) in which an "atropisomer" or an "internal rotation optical isomer" exists.

[0062]

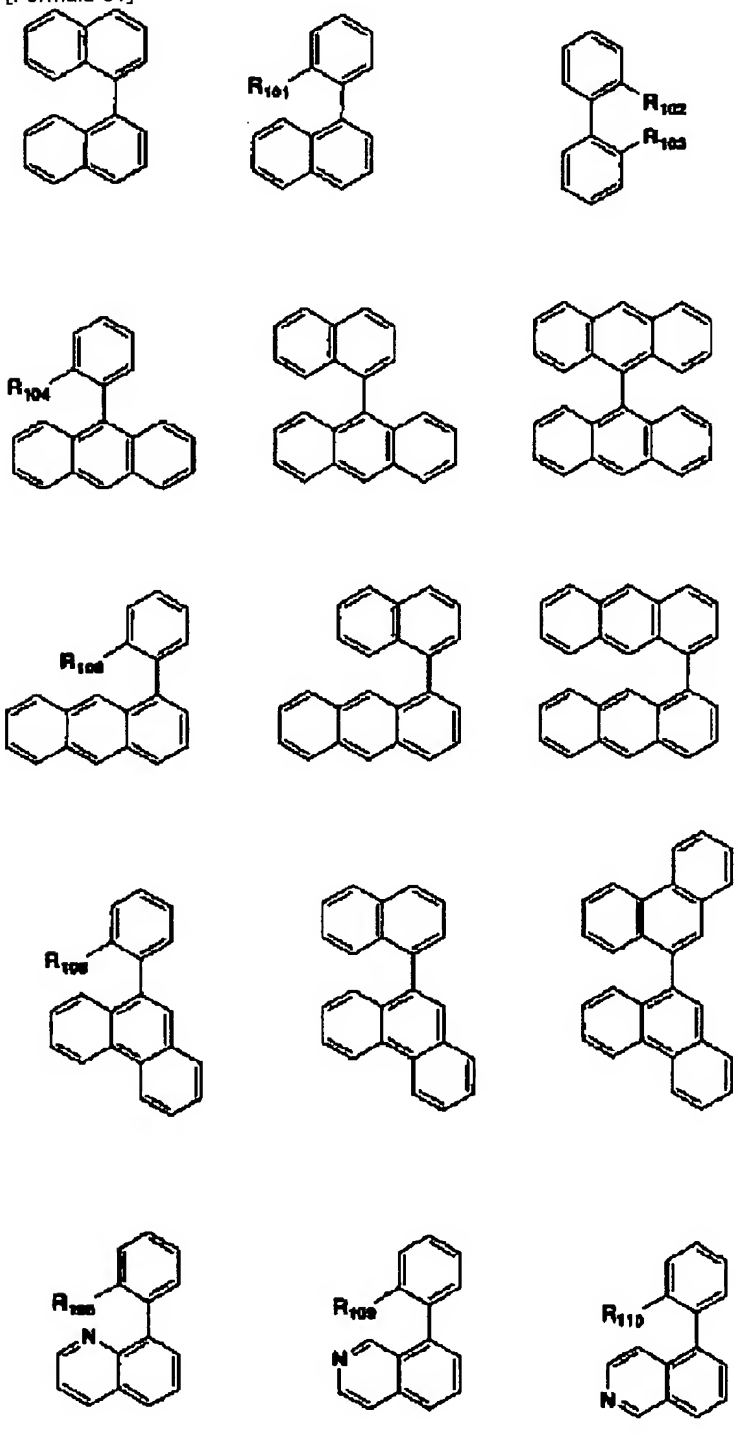
[Formula 30]



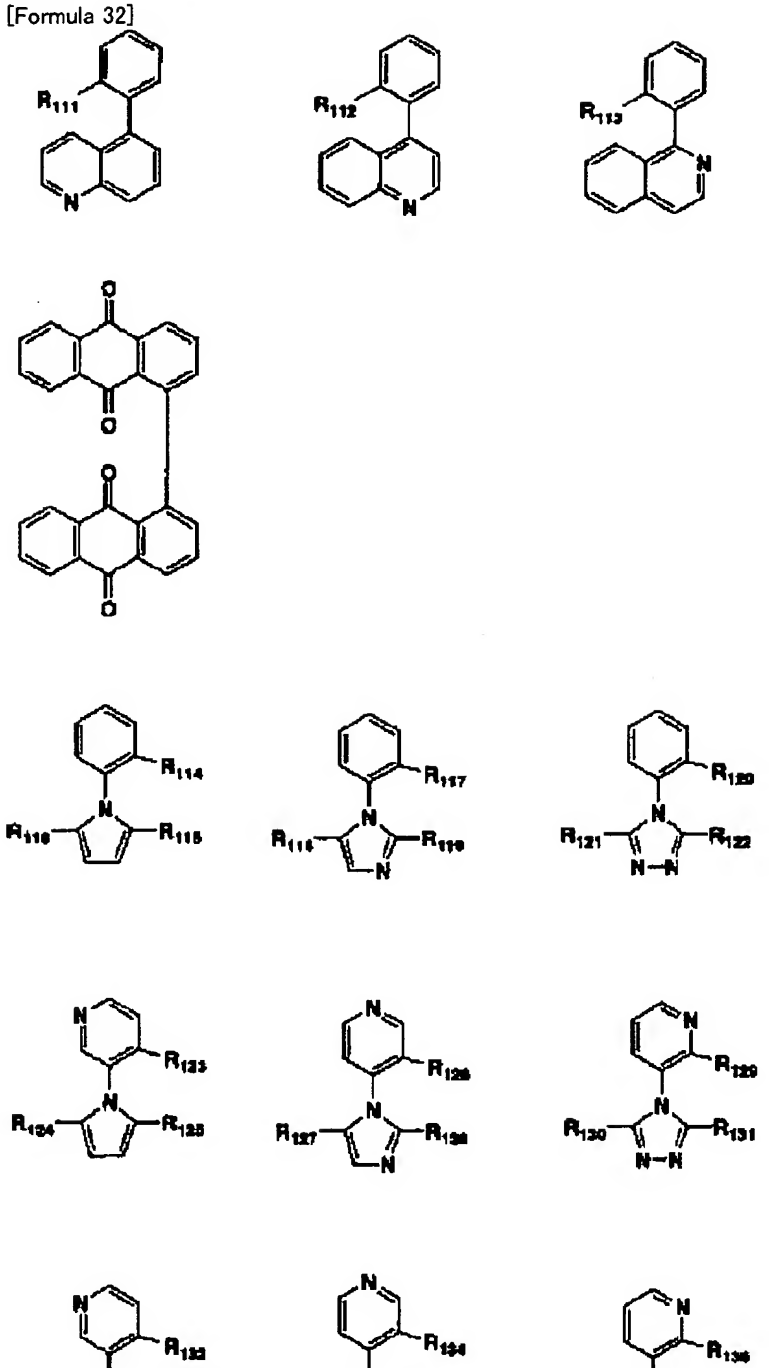
[0063]The basic skeleton of a substituent which has below "a beer reel group with the bond axis which can give internal rotation opposite-sex nature" (what removed the hydrogen atom of arbitrary positions serves as a substituent from the compound shown by a diagram.) The basic skeleton may be replaced by substituent which was further explained by R_{41}, and may form a condensed ring further. Although an example is shown, this invention is not limited to these.

[0064]

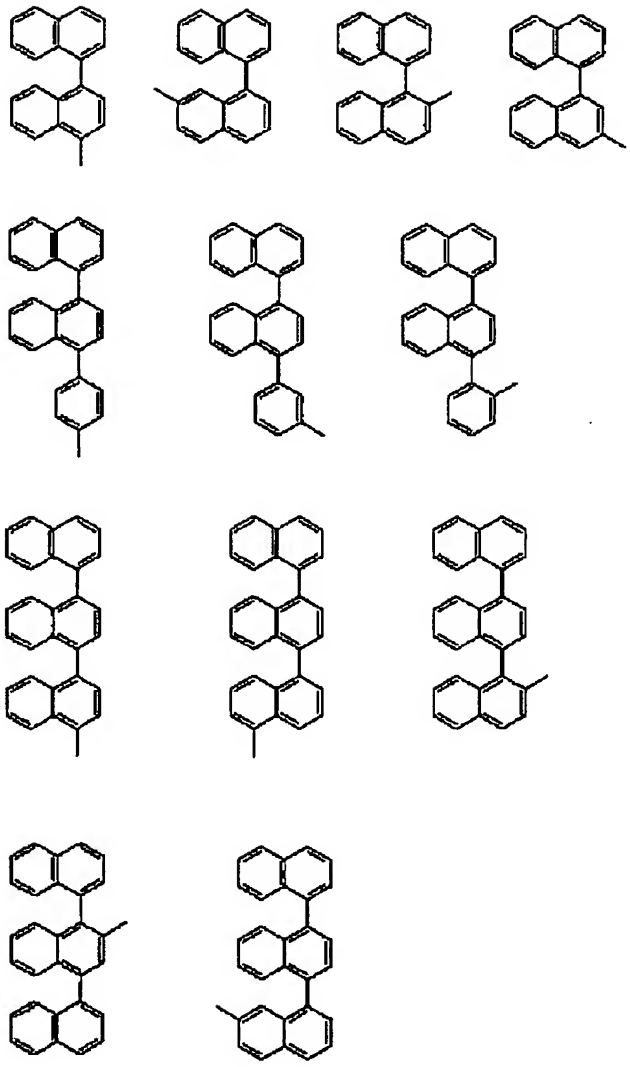
[Formula 31]



[0065]
[Formula 32]



[0066]
[Formula 33]



[0067]The metallic element expressed with M in a general formula (E1), If tetravalent ionic geometry can be taken from univalent, there will be no restriction in particular, but. Be, Mg, Ca, Sr, Ba, Zn, Cd, Hg, Pd, Cu, B, aluminum, Ga, In, Tl, Si, and germanium are preferred, Be, Mg, Ca, Sr, Ba, Zn, Cu, B, aluminum, Ga, and In are still more preferred, and Be, aluminum, Zn, and Ga are the most preferred.

[0068]A univalent anion which has a portion which can form M and an ionic bond which are expressed with L_{71}^- in a general formula (E1), and can be configurated in M, . The state where a proton was added on an oxygen atom, a sulfur atom, or a nitrogen atom in the state of acidity can be taken. Namely, a thing of a form where one proton was taken from a compound which has a dissociative group (-OH, -NH, -SH) is shown, and 2 thru/or 3-atom partition ****** from this oxygen atom, a sulfur atom, or a nitrogen atom — a nitrogen atom or a chalcogen atom (O.) It has an atom which can be configurated to S, Se, and metal like Te, and a nitrogen anion etc. which took a proton are mentioned from NH of the 1st place of an oxygen anion which took a proton from a hydroxyl group of 8-hydroxyquinoline, and 1H-2-(1-pyrazolyl) imidazole.

[0069]A univalent anion which forms M expressed with R_{71}^-, and an ionic bond in a general formula (E1), If an anion is generated under pH eight or more basic conditions, there will be no restriction in particular, For example, an anion etc. which removed one proton from 4-hydroxy-1,1'-biphenyl, 2-mercaptonaphthalene, 1H-pyrazolo [5,1-c], and [1, 2, 4] triazole are mentioned.

[0070]In a general formula (F1), with luminescent univalent compound residue expressed with Z_1 and Z_2. With luminescent compound residue of k value which expresses what removed a hydrogen atom or one substituent, and is expressed with Z_3 in a general formula (F2), from arbitrary positions of a compound in which luminescence is shown under a room temperature. Firefly luminescence or phosphorescence luminescence may be sufficient as "luminescence" of a compound in which what removed a hydrogen atom or k substituents is expressed from arbitrary positions of a compound in which luminescence is shown under a room temperature, and luminescence is shown under this room temperature.

[0071]As a luminescent compound which can serve as luminescent compound residue, A fluorochrome which has absorption in a visible region like a laser pigment, or a fluorescent compound which has absorption in an ultraviolet region like a fluorescent brightener, A phosphorescence luminescent compound still like a platina complex of porphyrin or a biacetyl may be sufficient, and specifically, For example, Kunio Yagi, Yoshikazu Yoshida, an organic fluorescent substance indicated to the 99th page - 122 pages of Toshikazu Ota collaboration "fluorescence -theory, measurement, and application -" (Nankodo), It is mentioned as the example of representation by a fluorescent brightener written in the 251st page - 270 pages of the writings, and fluorochrome further written in the 274th page - 287 pages of the writings, and preferably especially, A condensed ring type aromatic-hydrocarbon-rings compound represented by triphenylene, perylene, etc., A line conjugate polynuclear hydrocarbon compound represented by p-terphenyl, quarter phenyl, etc., An acridine, quinoline, carbazole, carbarsone, a fluorene, KISAN thione, A condensed ring type aromatic heterocyclic compound, a thiazole, oxazol, oxadiazole

which are represented by alloxazine, acridone, a flavone, a coumarin, naphthoimidazole, benzooxazol, dibenzo phenazine, etc., An aromatic heterocyclic compound represented by thiadiazole, triazole, etc., Amino KURORОMA laic imide, methylamino SHITORAKONIKKU methylimide, A conjugated system aliphatic compound represented by decapentaene carboxylic acid, decapentaene dicarboxylic acid, etc., The acridine orange NO, methylene blue, fluoro SEIN, eosine, A fluorochrome compound, oxa carbocyanine which are represented by a rhodamine, BENSO flavin, etc., Carbocyanine, thia carbocyanine, and 2 -(anilino polyethylene nil)- Sensitizing dye compounds, such as benzothiazole, A natural-coloring-matter compound represented by porphyrin, chlorophyll, riboflavin, etc., Diaminostilbene, JISUCHIRIRU benzene, benzidine, diaminocarbazole, Triazole, imidazole, a thiazole, oxazol, imidazolone, Dihydropyridine, a coumarin, carbo styryl, diamino dibenzo thiopheneoxide, fluorescent brightener of a diaminofluorene, oxa cyanine, a friend nonaphthalimide, pyrazoline, and an oxadiazole system etc. — it is mentioned, and these may have a substituent and may form a condensed ring further.

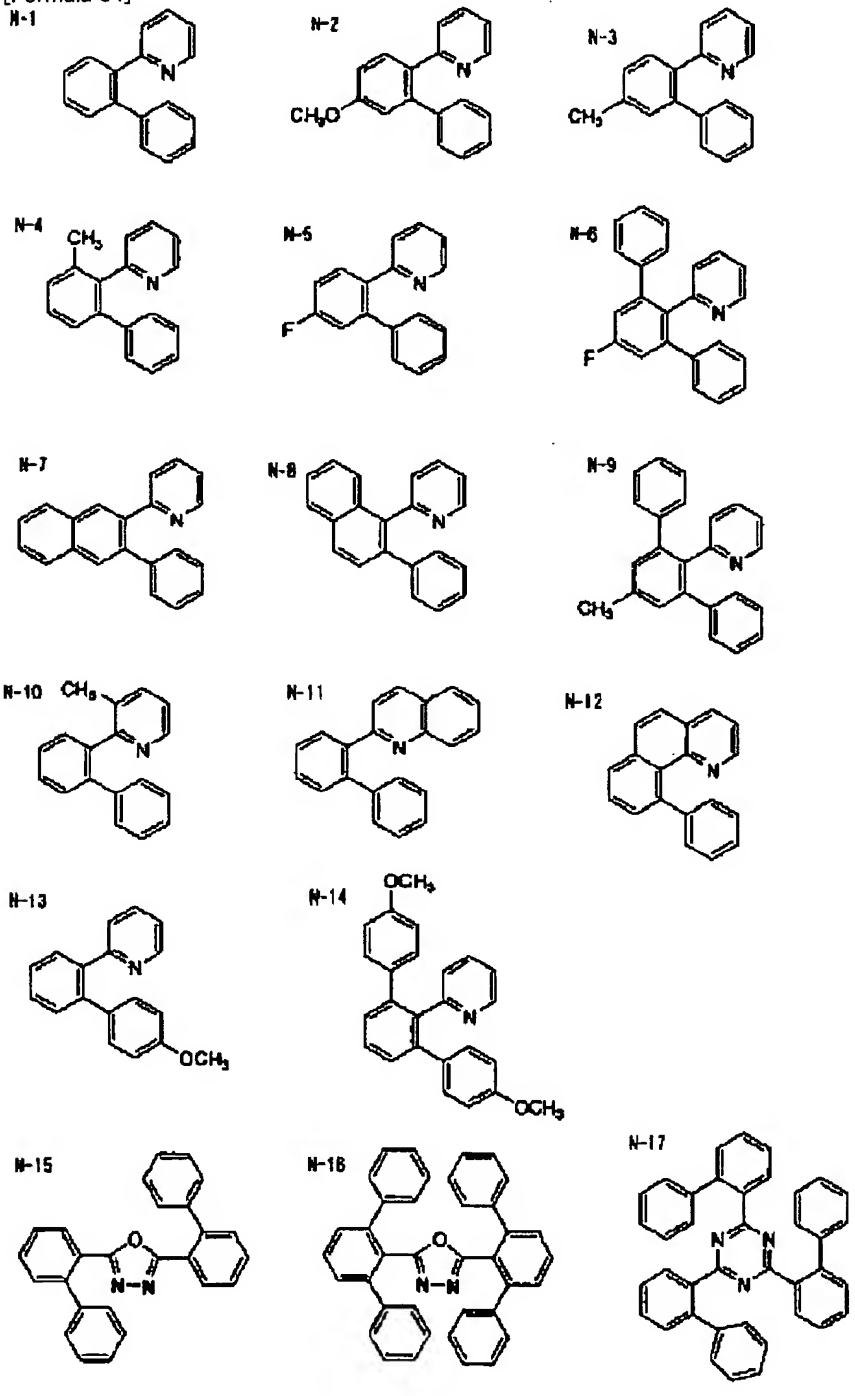
[0072]In a general formula (G1), although a fluorine atom, a chlorine atom, a bromine atom, iodine atoms, and an astatine atom are mentioned as a halogen atom expressed with X_{91}, things desirable in this are a bromine atom and iodine atoms.

[0073]Electroluminescence material may serve both as hole-injection material and electron injection material which are mentioned later in this invention. That is, it may have a hole injection and electron injection capability. Electroluminescence material may use together doping materials (it is also called a dopant and a guest) which make this material a host if needed.

[0074]Although an example of electroluminescence material of this invention is given to below, this invention is not limited to them.

[0075]

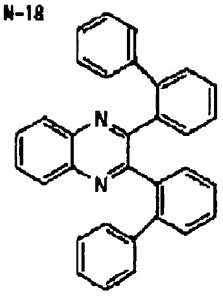
[Formula 34]



[0076]

[Formula 35]

N-18



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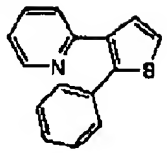

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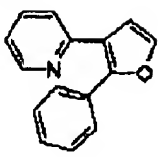
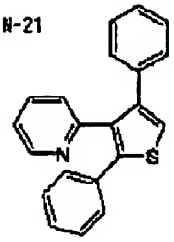
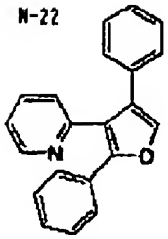


N-21



N-22



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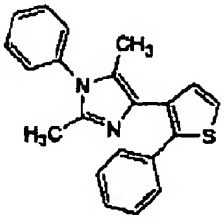

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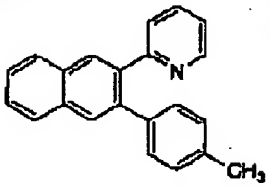
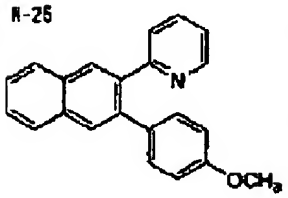
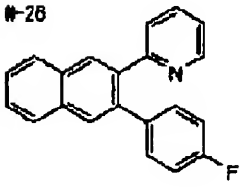


N-25



N-26



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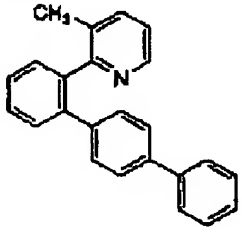
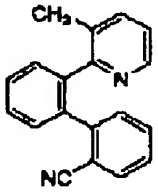
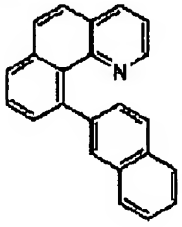


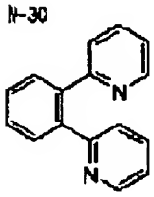
N-28



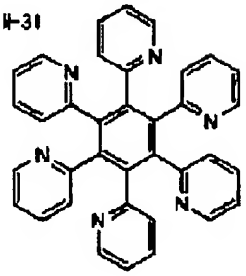
N-29



N-30

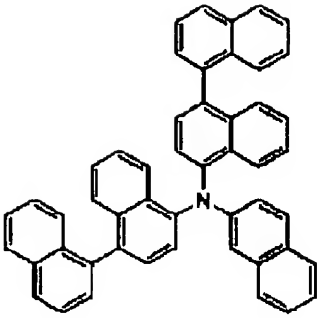


N-31



[0077]
[Formula 36]

A-1



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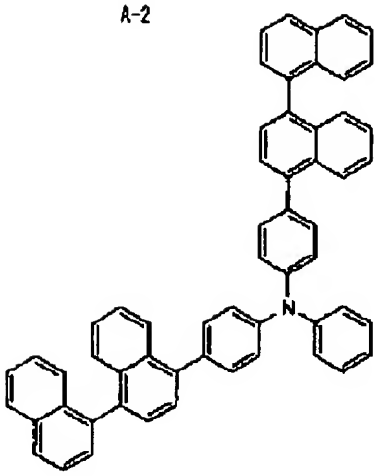
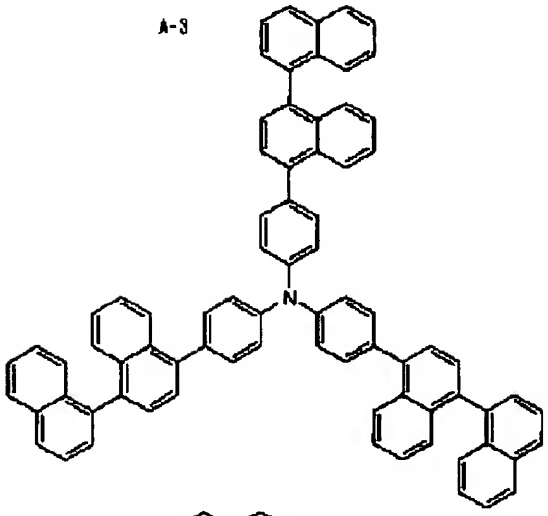


A-3



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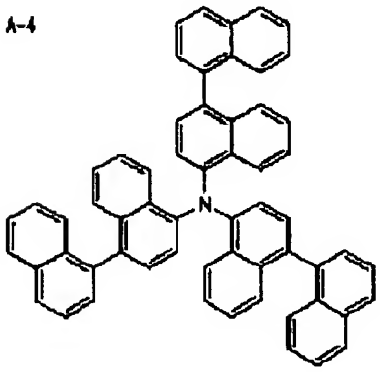
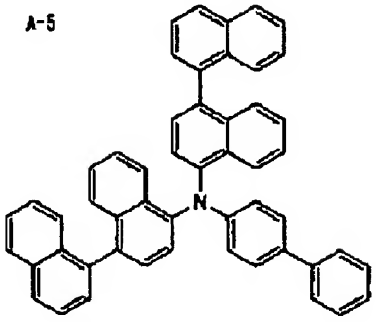
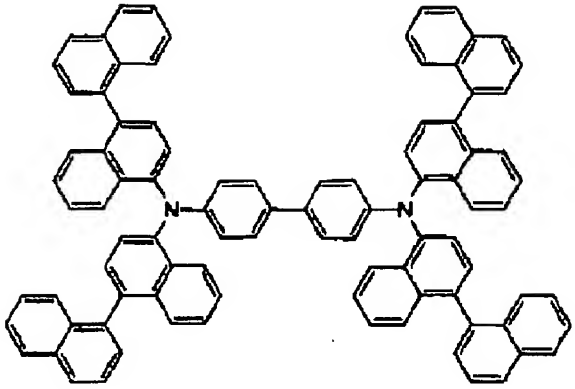


A-5

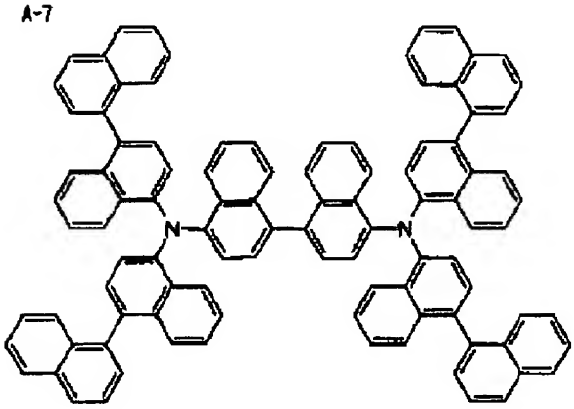


[0078]
[Formula 37]

A-6



A-7



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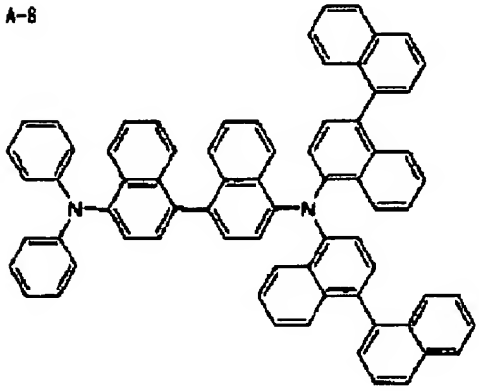
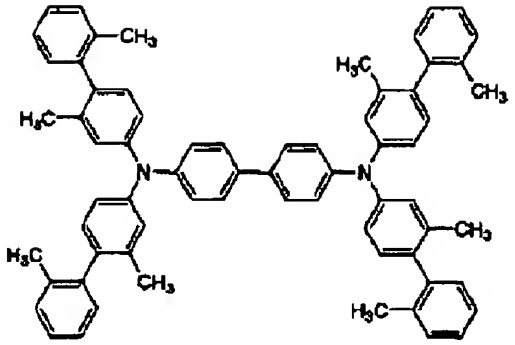
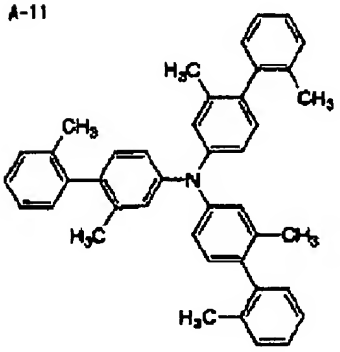


[0079]
[Formula 38]

A-10



A-11



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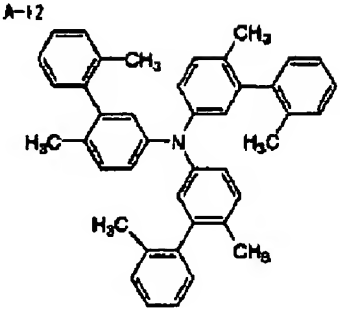
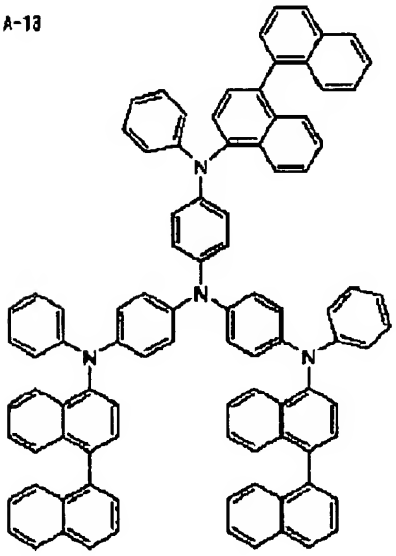
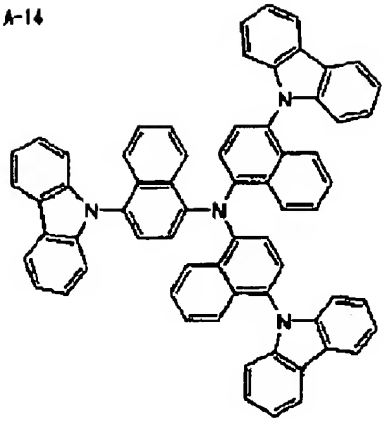


A-13



[0080]
[Formula 39]

A-14



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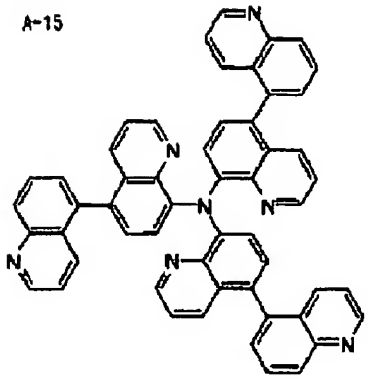

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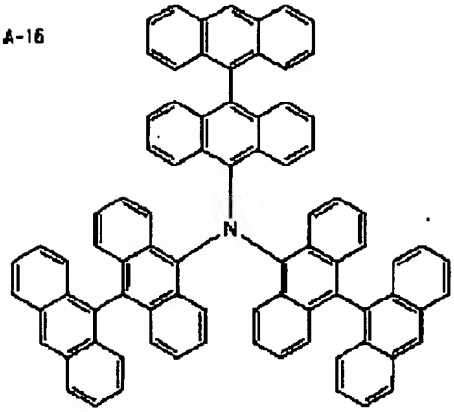
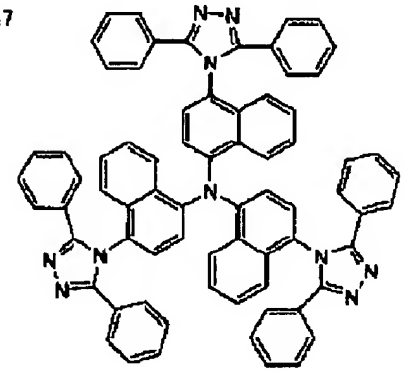


A-17



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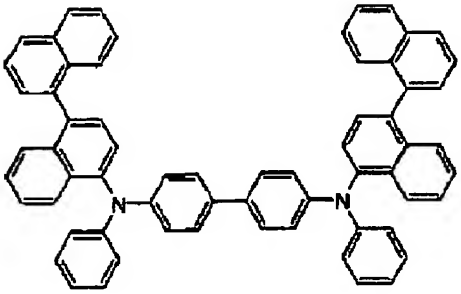
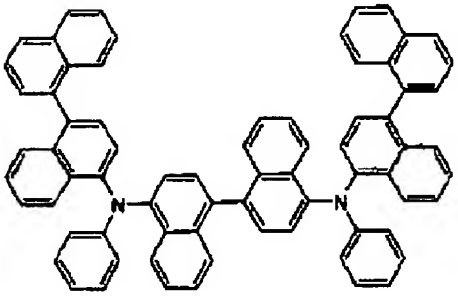
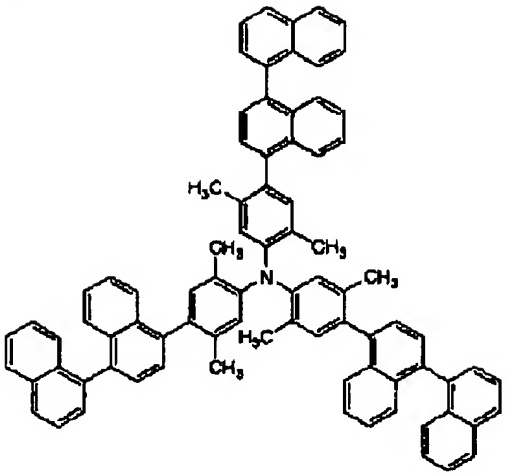


A-19



[0081]
[Formula 40]

A 20



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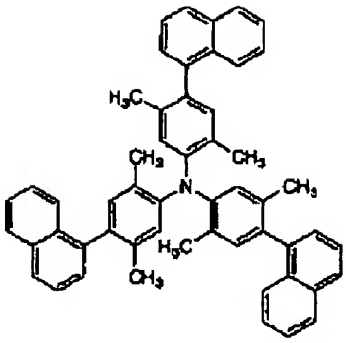
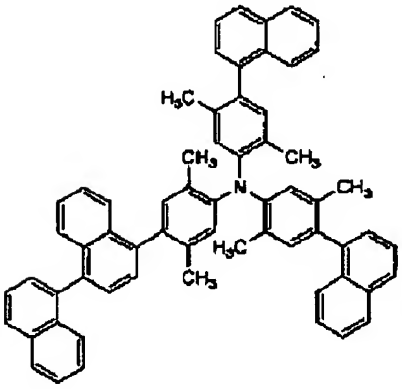
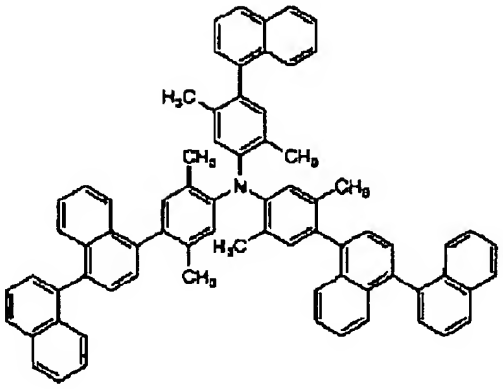


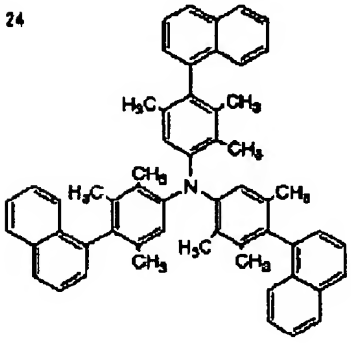
A-22



A 23



A 24



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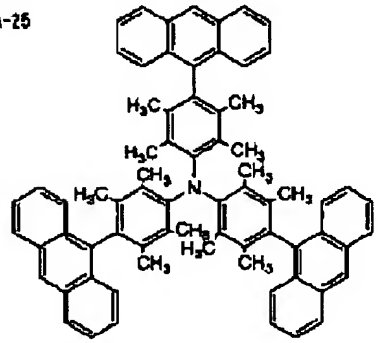
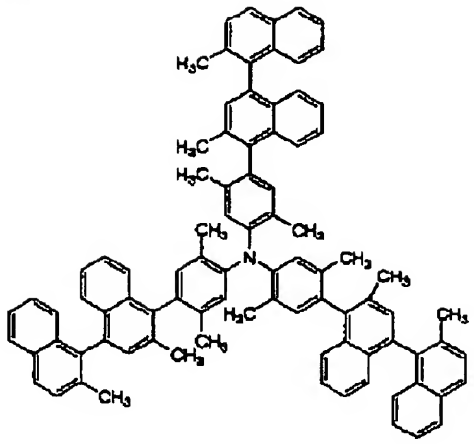


[0082]
[Formula 41]

A-26



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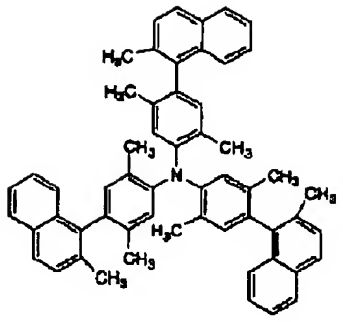
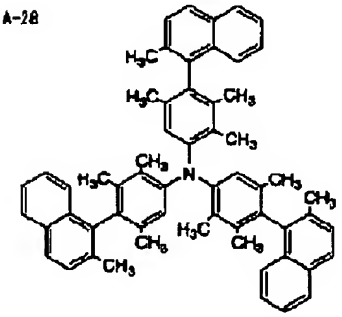


A-28



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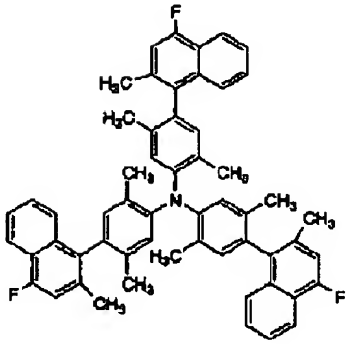
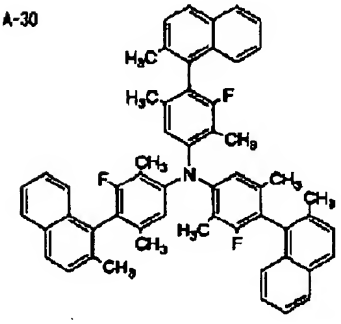
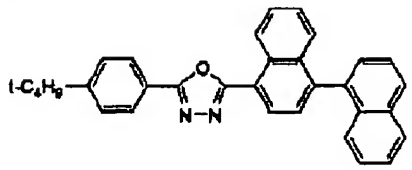


A-30

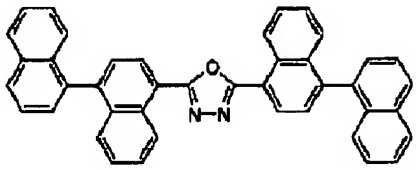


[0083]
[Formula 42]

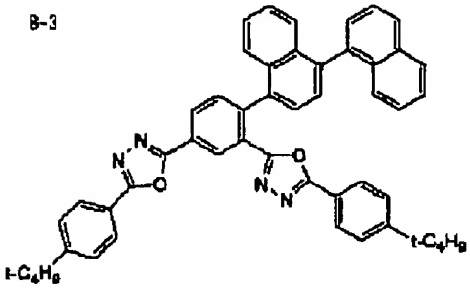
B-1



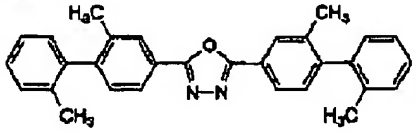
B-2



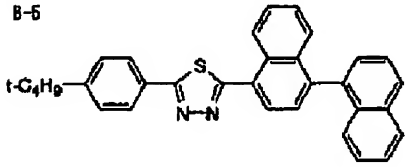
B-3



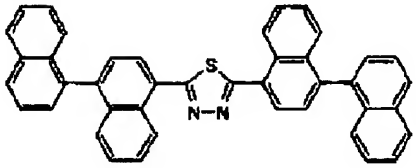
B-4



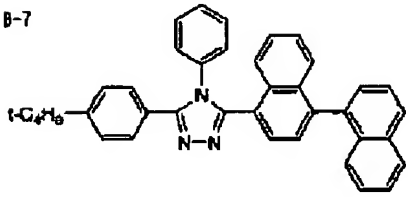
B-5



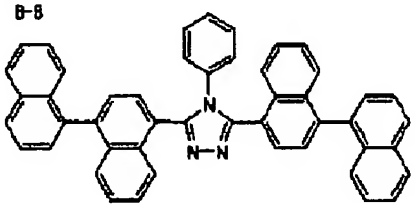
B-6



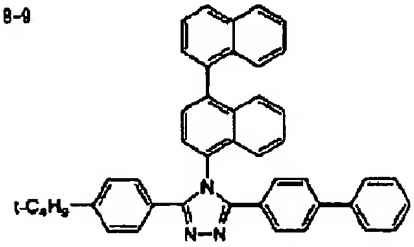
B-7



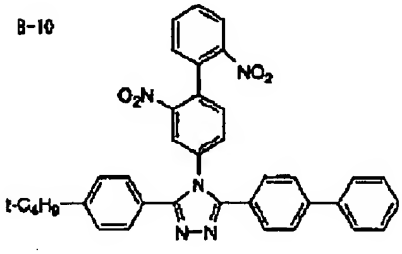
B-8



B-9

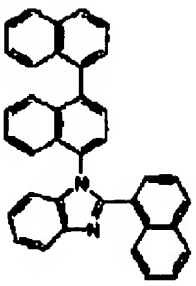


B-10

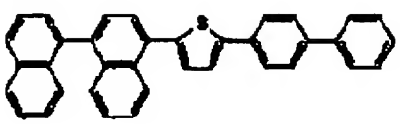


[0084]
[Formula 43]

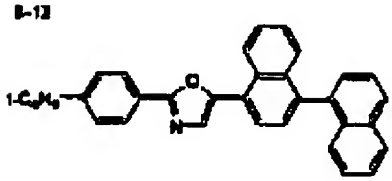
B-11



B-12



B-13



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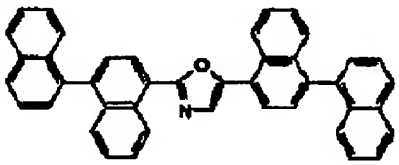
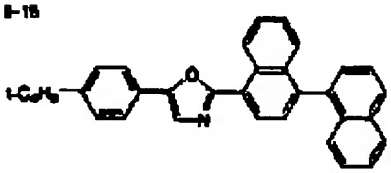
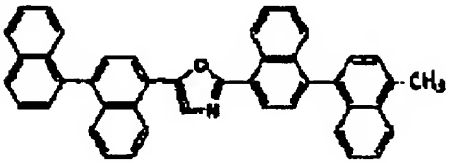


B-15



B-16



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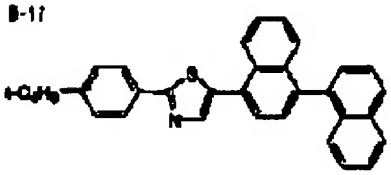
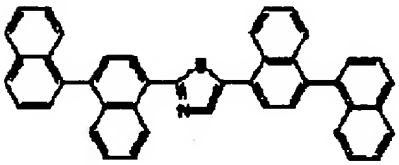
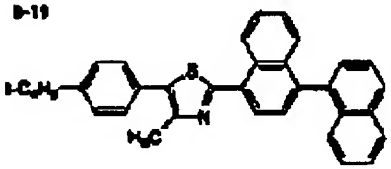


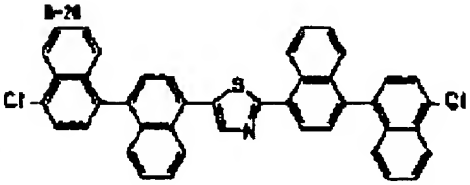
B-18



B-19

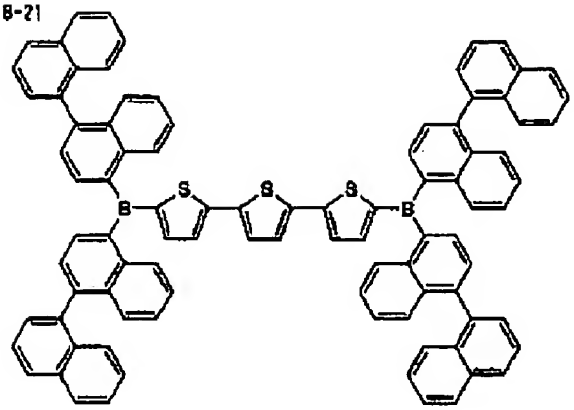


B-20

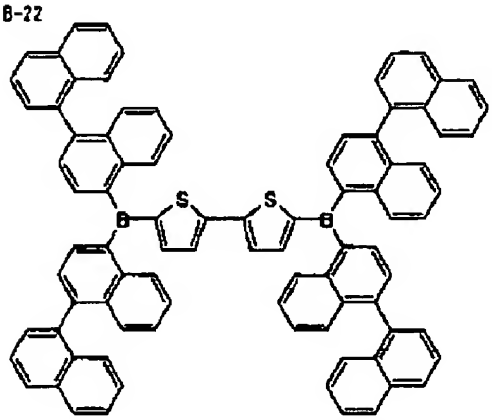


[0085]
[Formula 44]

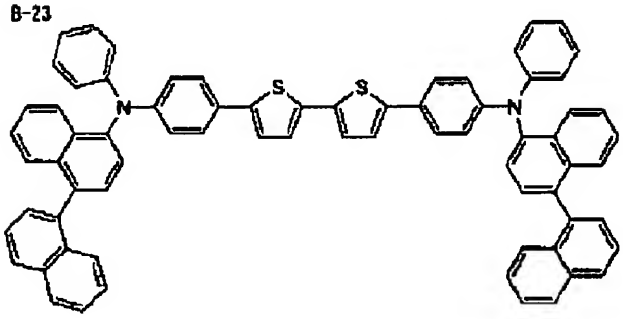
B-21



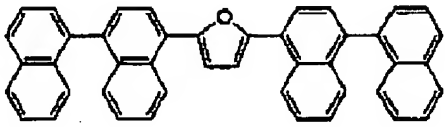
B-22



B-23

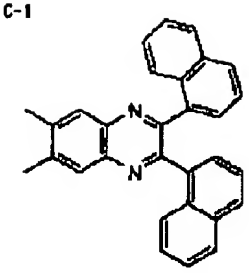


B-24

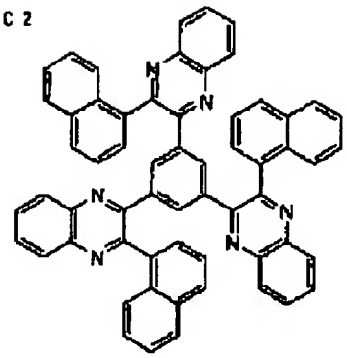


[0086]
[Formula 45]

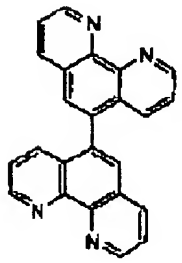
C-1



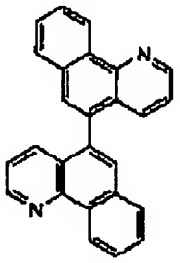
C-2



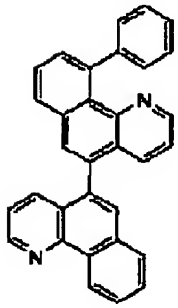
C-3



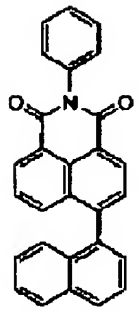
C-4



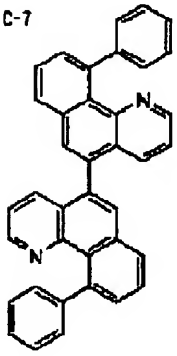
C-5



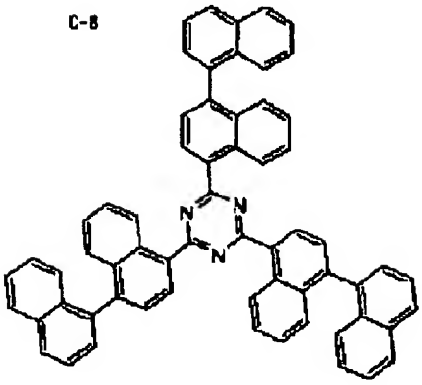
C-6



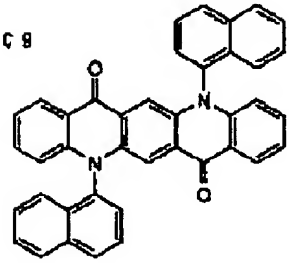
C-7



C-8

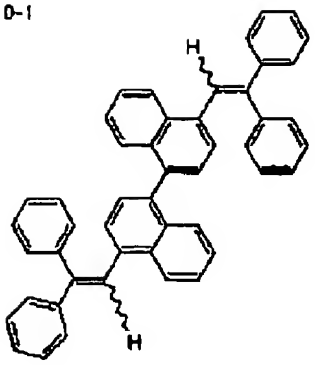


C-9

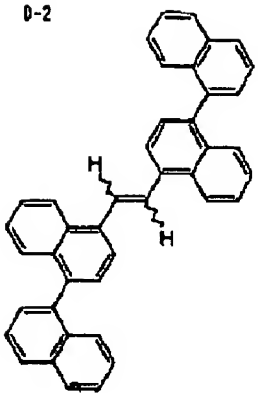


[0087]
[Formula 46]

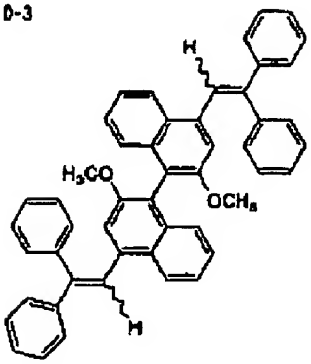
D-1



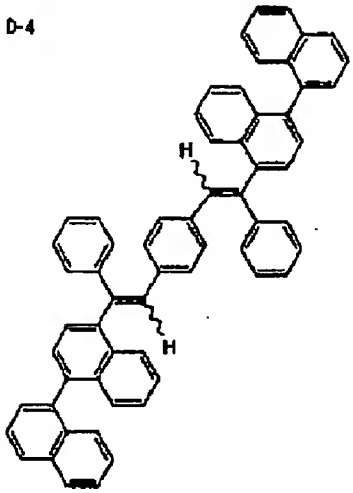
D-2



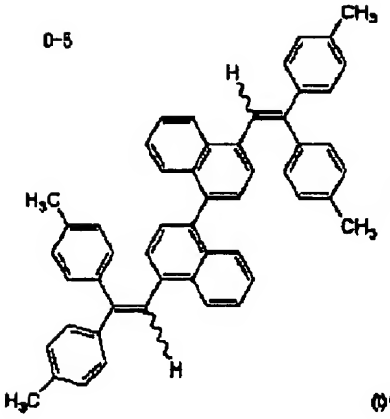
D-3



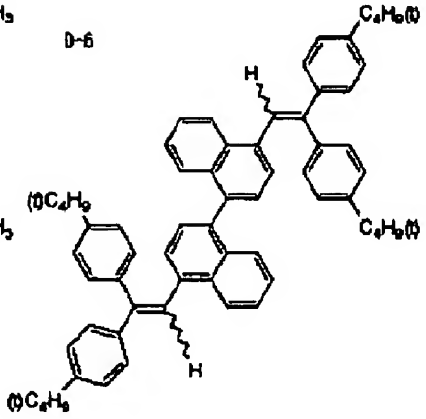
D-4



D-5

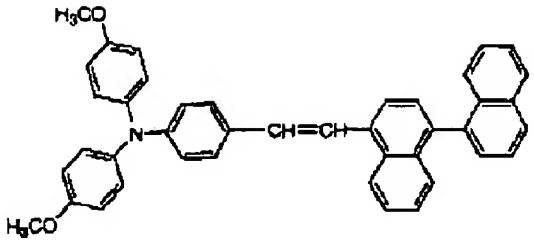


D-6

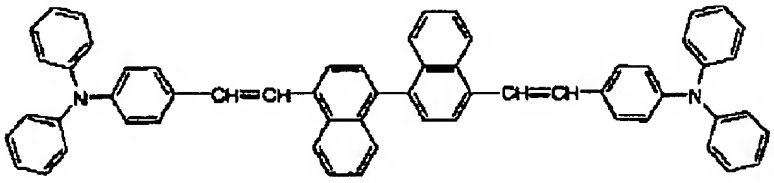


[0088]
[Formula 47]

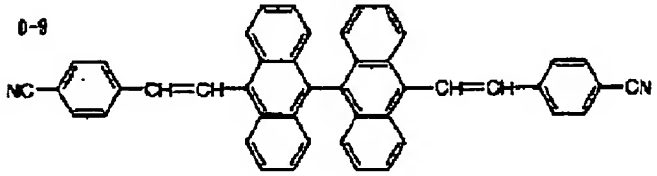
D-7



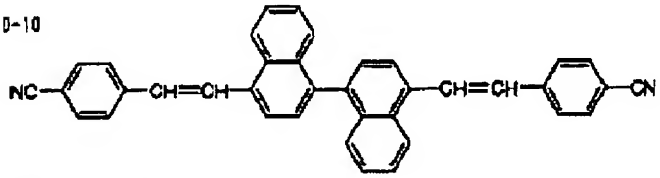
D-8



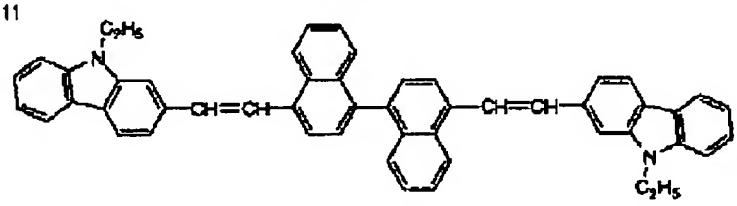
D-9



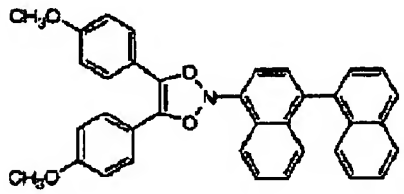
D-10



D 11

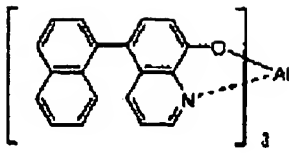


D-12

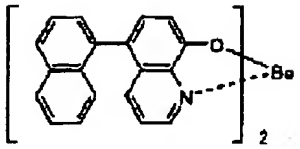


[0089]
[Formula 48]

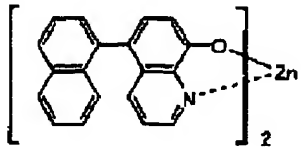
E-1



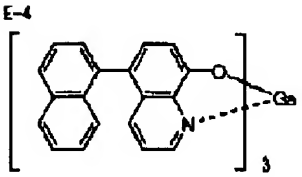
E-2



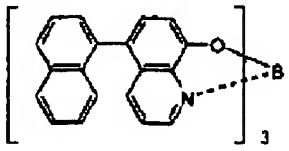
E-3



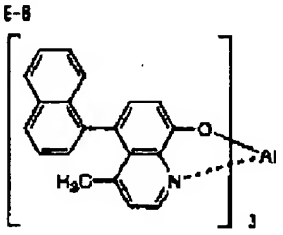
E-4



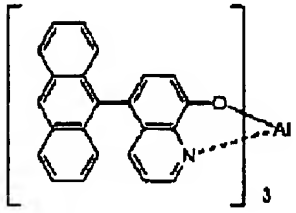
E-5



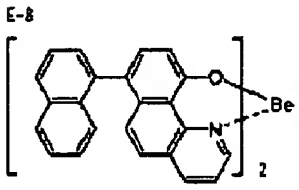
E-6



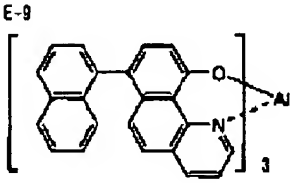
E-7



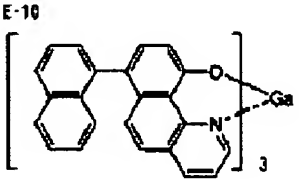
E-8



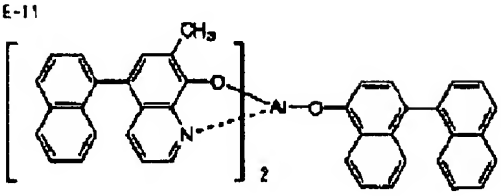
E-9



E-10

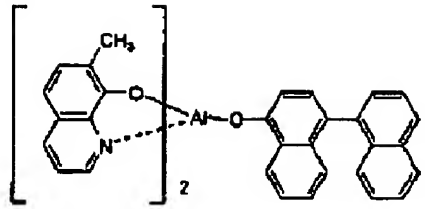


E-11

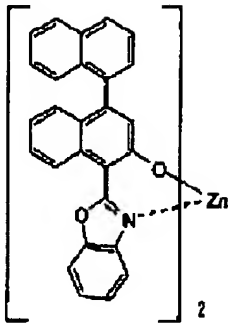


[0090]
[Formula 49]

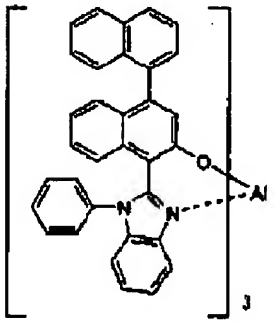
E-12



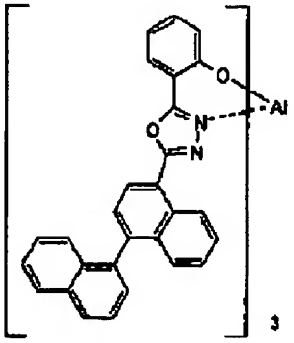
E-13



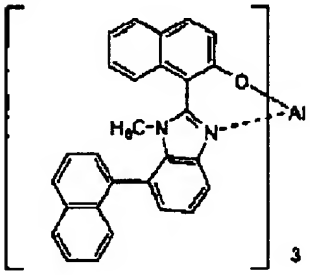
E-14



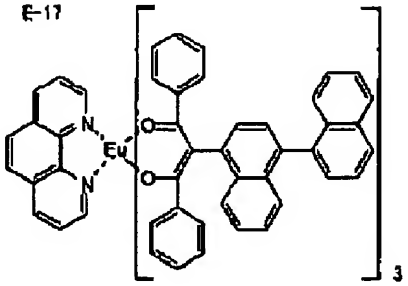
E-15



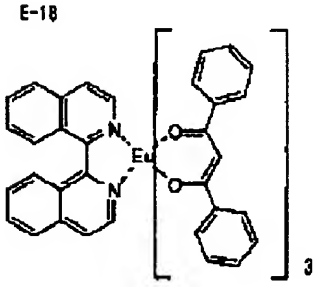
E-16



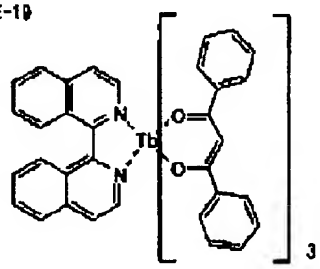
E-17



E-18

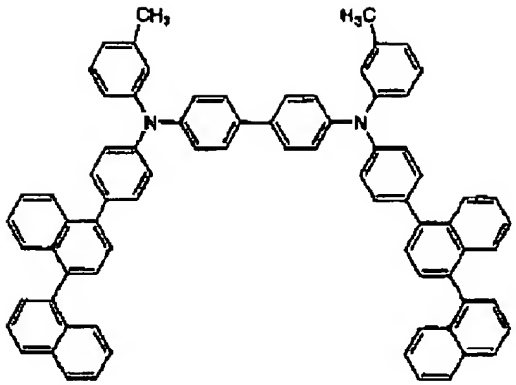


E-19

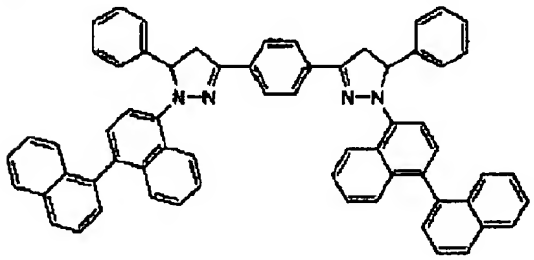


[0091]
[Formula 50]

F-1



F-2



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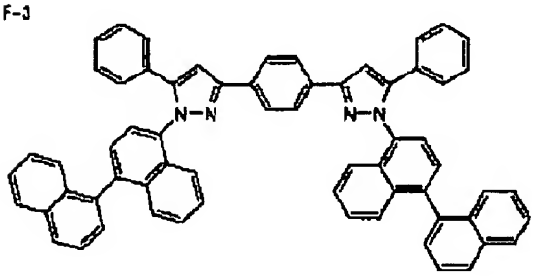
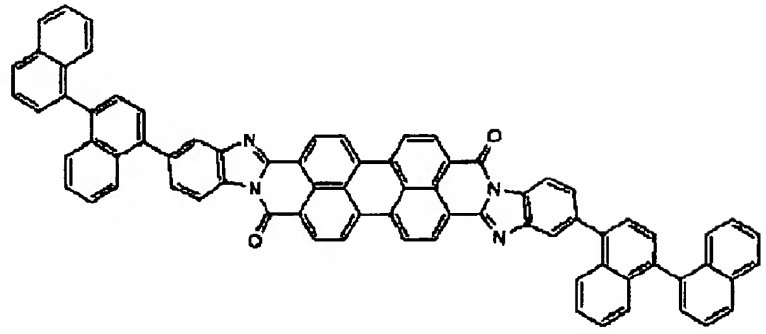
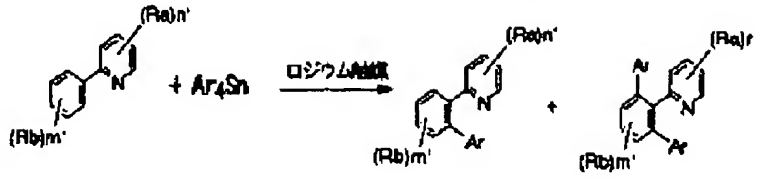


F-4



[0092]
[Formula 51]

スキーム1



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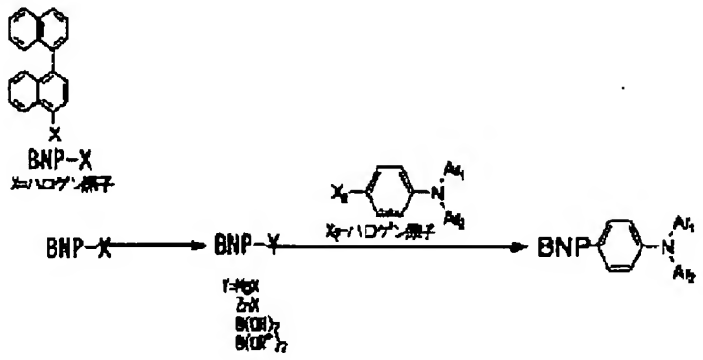
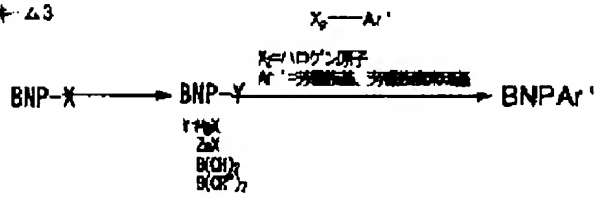


スキーム3



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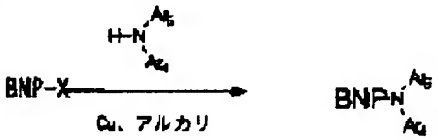

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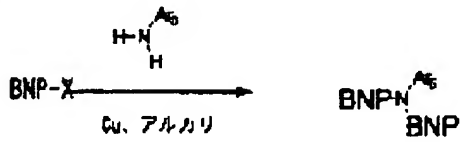
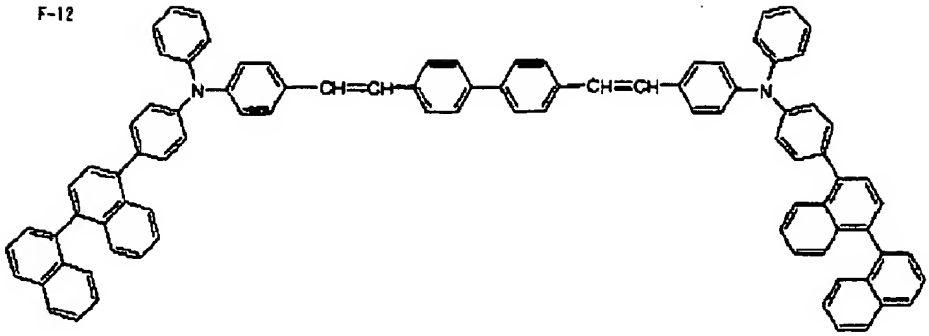
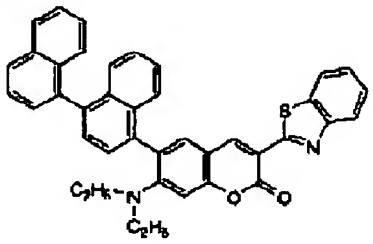


[0093]
[Formula 52]

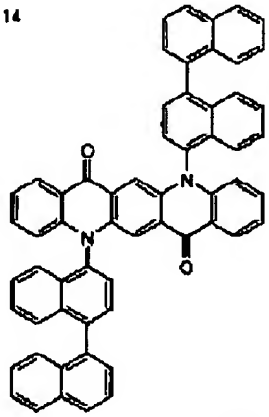
F-12



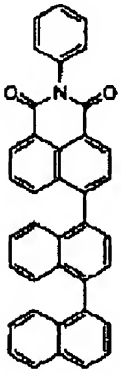
F-13



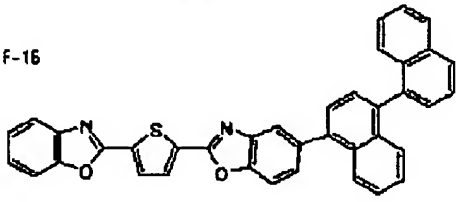
F 14



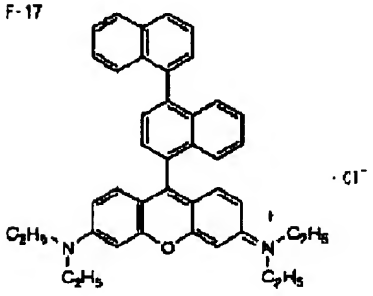
F 15



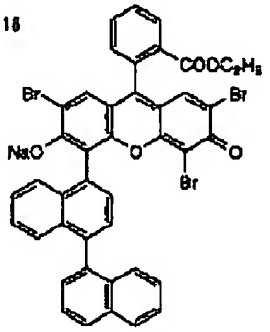
F-16



F-17

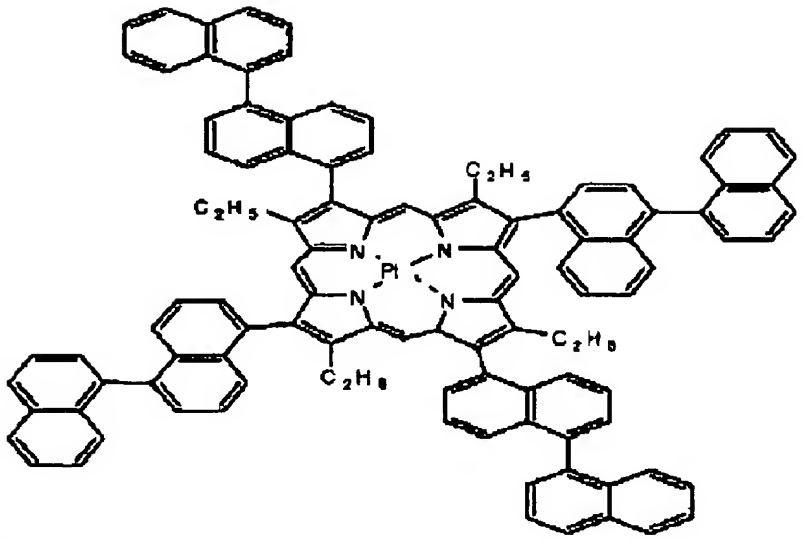


F 18

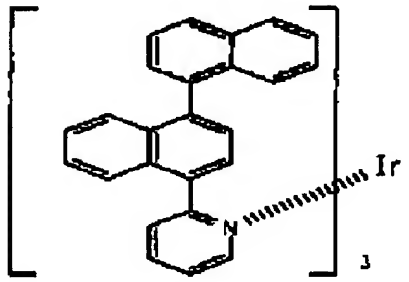


[0094]
[Formula 53]

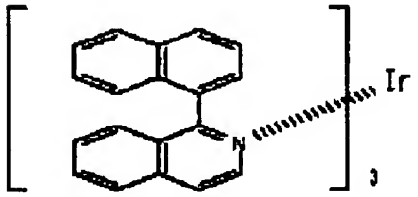
F 19



F-20



F-21



[0095]With next, the electroluminescent element as used in the field of this invention. The element which has a counterelectrode of a couple on both sides of the layer which contains the inorganic system fluorescent substance or rare earth complex system fluorescent substance which absorbs the light emitted from said lower electroluminescence material and this electroluminescence material, and shows a fluorescence on a base, and contains electroluminescence material is said. Here, it contains in layer with another electroluminescence material, inorganic system fluorescent substance, or rare earth complex system fluorescent substance, and does not exist in the same layer.

[0096]In a lower statement, especially, as long as there is no specification, electroluminescence material exists a layer containing a luminous layer in which layer of a luminous layer, a hole injection layer, and an electronic injection layer, and an inorganic system fluorescent substance and/or a rare earth complex system fluorescent substance exist in a color conversion layer.

[0097]An electroluminescent element in this invention may make an electronic injection layer and a hole injection layer intervene if needed.

[0098]A base preferably used for an electroluminescent element of this invention does not have limitation in particular in kinds, such as glass and a plastic, and if transparent, there will be no restriction in particular. As a base preferably used for an electroluminescent element of this invention, glass, quartz, and a light transmittance state plastic film can be mentioned.

[0099]As a light transmittance state plastic film, for example Polyethylene terephthalate (PET), Polyethylenenaphthalate (PEN), polyether sulphone (PES), A film etc. which consist of polyether imide, a polyether ether ketone, a polyphenylene sulfide, polyarylate, polyimide, polycarbonate (PC), cellulose triacetate (TAC), cellulose acetate propionate (CAP), etc. are mentioned.

[0100]Although it is preferred to use electroluminescence material of this invention for a luminous layer as for an electroluminescent element of this invention, it may be used together with a publicly known luminescent material. Specifically, they are "an organic EL device and its industrialization front line". November 30, 1998 N Tea S issue. (it may be hereafter called the literature A.) — a low molecule system luminescent material indicated in Chapter 3 per piece [the] (the 35th page – the 51st page). Coloring matter dope material indicated in Chapter 4 per piece [the] of the literature A (the 55th page – the 79th page), polymers system material indicated in Chapter 5 per piece [the] of the literature A (the 81st page – the 100th page, the 178th page – the 189th page, 192 pages – the 212nd page of ****), etc. can be mentioned. A compound which has gone up to a cited document in these articles can be used similarly.

[0101]An electroluminescent element contains a monolayer or two or more layers in inter-electrode [two], and is usually constituted, As this composition layer, a hole injection layer (or it is also called an electric charge pouring layer, a hole pouring layer, a charge transport layer, and a hole transporting bed), an electronic injection layer (or it is also called an electron transport layer), etc. other than said luminous layer are mentioned.
[0102]The above, a hole injection layer, and an electronic injection layer may take a laminated structure further if needed, for example, may take lamination like the anode / the 1st hole injection layer / the 2nd hole injection layer (electron hole transporting bed) / luminous layer / the 2nd electronic injection layer (electron transport layer) / the 1st electronic injection layer / negative pole.
[0103]An example of lamination of an electroluminescent element in this invention is shown below (however, although a statement about two or more hole injection layers and/or electronic injection layers is omitted like the above, naturally they may form a laminated structure which becomes in piles about two or more compounds.).
A substrate / color conversion layer / substrate / anode / luminous layer / negative pole. (2) A substrate / color conversion layer / substrate / anode / hole injection layer / luminous layer / negative pole. (3) A substrate / color conversion layer / substrate / anode / luminous layer / electronic injection layer / negative pole. (4) A substrate / color conversion layer / substrate / anode / hole injection layer / luminous layer / electronic injection layer / negative pole (5) board / anode / luminous layer / negative pole / color conversion layer / substrate (6) board / anode / hole injection layer / luminous layer / negative pole / color conversion layer / substrate (7) board / anode / luminous layer / electronic injection layer / negative pole / color conversion layer / substrate. (8) a substrate / anode / hole injection layer / luminous layer / electronic injection layer / negative pole / color conversion layer / substrate — here, a substrate which touches a substrate which touches a color conversion layer, and the anode may be the same, or it may differ, and the outside of each element may be further covered with a substrate.
[0104]A buffer layer (electrode interface layer) may be made to exist between the anode, a luminous layer, or a hole injection layer and between the negative pole, a luminous layer, or an electronic injection layer.
[0105]A buffer layer is a layer provided between an electrode and an organic layer for a driver voltage fall or improvement in luminous efficiency, it is indicated in detail in piece [2nd] chapter 2 of the literature A "electrode material" (the 123rd page - the 166th page), and there are an anode buffer layer and a cathode buffer layer.
[0106]A phthalocyanine buffer layer represented by copper phthalocyanine as an anode buffer layer, A polymers buffer layer using conductive polymers represented by vanadium oxide, such as an oxide buffer layer, an amorphous carbon buffer layer, poly aniline (EMERARU DIN), and a polythiophene, etc. are mentioned.
[0107]A metal buffer layer represented by strontium, aluminum, etc. as a cathode buffer layer, An alkali-metal-compound buffer layer represented by lithium fluoride, an alkaline earth metal compound buffer layer represented by magnesium fluoride, an oxide buffer layer represented by aluminum oxide, etc. are mentioned.
[0108]As for the above-mentioned buffer layer, it is desirable that it is a very thin film, and although based also on a raw material, the thickness has the preferred range of 0.1-100 nm.
[0109]Although it can form by thin-film-izing, for example by publicly known methods, such as vacuum deposition, a spin coat method, the cast method, and the LB method, as a method of forming a luminous layer, a hole injection layer, an electronic injection layer, or a buffer layer, it is preferred that it is especially a molecule deposited film. Here, molecule deposited films are a thin film deposited and formed from a vapor phase state of this compound, and a film solidified and formed from a molten state or a liquid phase state of this compound. Usually, this molecule deposited film is distinguishable according to a thin film (molecule built up film) formed by the LB method, and a difference of condensation structure and higher order structure and a functional difference resulting from it.
[0110]After this luminous layer melts the above-mentioned luminescent material in a solvent and considers it as a solution with binding materials, such as resin, as indicated to JP,57-51781,A, it can thin-film-ize this with a spin coat method etc., and can form it. Thus, although there is no restriction in particular about thickness of a formed luminous layer and it can choose suitably according to a situation, it is preferred to be used in 5 nm - 5 micrometers.
[0111]What uses large (not less than 4 eV) metal, an alloy, electrical conductivity compounds, and these mixtures of a work function as electrode material as the anode in this electroluminescent element is used preferably. As an example of such electrode material, conductive transparent materials, such as metal, such as Au, CuI, indiumtinoxide (ITO), SnO_2, ZnO, and zinc dope indium oxide (IZO), are mentioned. This anode such electrode material by methods, such as vacuum evaporation and sputtering. When a thin film may be made to form, and a pattern of desired shape may be formed with the photolithographic method or you seldom need pattern accuracy, it may form a pattern via a mask of desired shape at the time of vacuum evaporation and sputtering of (about not less than 100 micrometers) and the above-mentioned electrode material.
[0112]When taking out luminescence from this anode, it is desirable to make transmissivity larger than 10%, and below 10 ^{3}omega/** of sheet resistance as the anode are preferred. Although thickness of the anode can be suitably chosen with material, it is preferred to use at 10 nm - about 1 micrometer, and it is still more preferred that it is 10-200 nm.
[0113]What, on the other hand, uses small (less than 4 eV) metal (electron injectional metal may be called), an alloy, electrical conductivity compounds, and these mixtures of a work function as electrode material as the negative pole is used. As an example of such electrode material, potassium, sodium, a sodium potassium alloy, Magnesium, lithium, magnesium / copper mixture, magnesium / silver mixture, Magnesium / aluminum mixture, magnesium / indium mixture, aluminum / aluminum oxide (aluminum$_2O_3$) mixture, indium, lithium / aluminum mixture, a rare earth metal, etc. are mentioned.
[0114]From a durable point of as opposed to electron injection nature, oxidation, etc. in inside of these to magnesium / silver mixture. Like magnesium / aluminum mixture, magnesium / indium mixture, aluminum / aluminum oxide (aluminum$_2O_3$) mixture, and lithium / aluminum mixture, a mixture of electron injectional metal and metal with a bigger value of a work function than this is preferred.
[0115]However, in using it, painting the above cathode buffer layers on a cathode surface. The negative pole by using fluoride of an alkaline metal or alkaline-earth metals for a cathode buffer layer (an "electronic injection layer" is called in this patent specification) as restriction of a work function is canceled, for example, it is indicated to JP,11-224783,A ITO and SnO_2, As a big substance of a work function used can also be used as the usual anodes, such as In_2O_3 and ZnO:aluminum, and it is indicated to the 15th line - the 28th page [145th] line of the literature A, By using lithium fluoride (0.5-1 micrometer of

thickness) as a cathode buffer layer, It is known that aluminum can use it as a cathode material etc., and an element defined by the periodic tables, such as said metallic oxide, silver besides aluminum, copper, and platina ** gold, as "metal" can be used as a cathode material in a case of using such a cathode buffer layer.
[0116]This negative pole can produce such electrode material by making a thin film form by methods, such as vacuum evaporation and sputtering. It is also possible to create with plating which is indicated to JP,11-8074,A.
[0117]Below 10 ^{3}omega/** of sheet resistance as the negative pole are preferred. As for thickness of the negative pole, it is preferred that they are 10 nm - 100 micrometers, and it is still more preferred that it is 50-2000 nm.
[0118]In order to make luminescence penetrate, luminous efficiency whose electrode located between a luminous layer of an electroluminescent element and a color conversion layer is transparent or translucent improves, and it is preferred.
[0119]That an electrode is transparent or that it is translucent mean here that visible light transmittance at 400 nm - 700 nm is not less than 20%, and it is preferred that it is not less than 50%. a hole injection layer formed if needed in this invention having the function to transmit an electron hole poured in from the anode to a luminous layer, and making this hole injection layer intervene between the anode and a luminous layer — a lower electric field — many electron holes — a luminous layer — notes ON — last ** An interface in a luminous layer accumulates with a barrier of an electron poured into a luminous layer from the negative pole or an electronic injection layer, and an electron which exists in an interface of a luminous layer and a hole injection layer, and it becomes the element which was excellent in luminescent ability — luminous efficiency improves.
[0120]About material (henceforth hole-injection material) used for this hole injection layer, if it has the aforementioned function, there will be no restriction in particular, and arbitrary things can be conventionally chosen and used out of a publicly known thing.
[0121]The above-mentioned hole-injection material may have barrier either electronic pouring of an electron hole or nature, and may be any of an organic matter and an inorganic substance.
[0122]Into an organic hole-injection material, for example JP,63-295695,A, JP,2-191694,A, JP,3-792,A, JP,5-234681,A, Various organic compounds indicated in JP,5-239455,A, JP,5-299174,A, JP,7-126225,A, JP,7-126226,A, JP,8-100172,A, EP 0650955ANo. 1 gazette, etc. can be used. For example, they are a phthalocyanine derivative, a tetra aryl BENJISHIN compound, the third class of aromatic amine, a hydrazone derivative, a carbazole derivative, a triazole derivative, an imidazole derivative, an oxadiazole derivative that has an amino group, a polythiophene, etc. These compounds may use two or more sorts together, and when using together, they are made into a different layer, and they should just laminate or mix them.
[0123]When laminating and using a hole injection layer, desirable combination can be chosen and used out of the above-mentioned compound (when using a function of a hole injection and electron hole transportation properly). At this time, it is preferred to laminate in order of a layer of a small compound of ionization potential from the anode sides (ITO etc.). It is preferred to use for the anode surface a filmy (film production nature) good compound (for example, a starburst type compound etc. which are indicated to JP,4-308688,A etc. are the example of representation).
[0124]As an example of representation of the above-mentioned aromatic tertiary-amine compound and a styryl amine compound, it is a N,N,N',N'-tetraphenyl-4,4'-diaminophenyl and N,N'-diphenyl-N,N'-screw (3-methylphenyl). - [1,1'-biphenyl] -4,4'-diamine (TPD), 2,2-bis(4-di-p-tolylamino phenyl)propane, 1,1-bis(4-di-p-tolylamino phenyl)cyclohexane, N,N,N',N'-tetra-p-tolyl 4,4'-diaminobiphenyl, 1,1-bis(4-di-p-tolylamino phenyl)-4-phenylcyclohexane, A bis(4-dimethylamino 2-methylphenyl)phenylmethane, A bis(4-di-p-tolylamino phenyl)phenylmethane, N,N'-diphenyl-N,N'-JI (4-methoxypheny)-4,4'-diaminobiphenyl, N,N,N',N'-tetraphenyl-4,4'-diaminodiphenyl ether, 4,4'-bis(diphenylamino)KUODORI phenyl, N,N,N-Tori (p-tolyl) amine, 4-(di-p-tolylamino)-4' - [4-(di-p-tolylamino) styryl] A stilbene, 4-N,N-diphenylamino (2-diphenylvinyl) benzene, 3-methoxy-4'-N,N-diphenylamino still benzene, N-phenylcarbazole, and a thing that has further two fused aromatic rings written in a U.S. Pat. No. 5061569 specification in intramolecular, for example, a 4,4'-screw [N-(1-naphthyl)-N-phenylamino] 4, 4', 4"-tris by which biphenyl (NPD) and a triphenylamine unit indicated to JP,4-308688,A were connected with 3 starburst type [N-(3-methylphenyl)-N-phenylamino] A triphenylamine (MTDATA) etc. are mentioned.
[0125]P type-Si, p type-SiC, etc. can be used as an inorganic hole-injection material.
[0126]This hole injection layer can form the above-mentioned hole-injection material, for example by thin-film-izing by publicly known methods, such as a vacuum deposition method, a spin coat method, the cast method, and the LB method. Although there is no restriction in particular about thickness of a hole injection layer, it is preferred that they are 5 nm - about 5 micrometers.
[0127]The electronic injection layer used if needed should just have the function to transmit an electron poured in from the negative pole to a luminous layer, and as the material, conventionally, out of a publicly known compound, it can choose arbitrary things and it can be used for it.
[0128]An electronic injection layer is formed when an electron injection transportation function of a compound used for a luminous layer is not so high, and it has a function which bars a function which makes pouring of an electron from the negative pole easy, a function to convey an electron, and an electron hole. An electron injection transporting bed may be separately provided in a layer with a pouring function, and a layer with a transportation function.
[0129]As an example of material (henceforth electron injection material) used for this electronic injection layer, A nitration fluorene derivative, a diphenyl quinone derivative, a thiopyrandioxide derivative, Heterocyclic tetracarboxylic anhydrides, such as naphthalene perylene, a carbodiimide, a FUREORENIRIDEN methane derivative, anthra quinodimethane and the Antron derivative, an oxadiazole derivative, etc. are mentioned. A series of electron transport nature compounds indicated to JP,59-194393,A can be used also as an electron injection material, although indicated in this gazette as a material which forms a luminous layer. A thiadiazole derivative which replaced an oxygen atom of an oxadiazole ring by a sulfur atom in the above-mentioned oxadiazole derivative, A triazole derivative replaced by arylamino group and an alkylamino group and a quinoxaline derivative which has the quinoxaline ring known as an electron withdrawing group can also be used as an electron injection material.
[0130]A metal complex (Alq), for example, tris(eight quinolinol) aluminum, of an eight-quinolinol derivative, Tris(5,7-dichloro-eight quinolinol) aluminum, tris(5,7-dibromo-eight quinolinol) aluminum, Tris(2-methyl-eight quinolinol) aluminum, tris(5-methyl-eight quinolinol) aluminum, Metal complexes in which a central metal of these metal complexes replaced In, Mg, Cu, Ca, Sn, Ga, or Pb, such as bis(eight quinolinol)zinc (Znq), can also be used as an electron injection material. In addition, said literature A ** Editing ** That by which metal complex system material of a statement, metal free metal phthalocyanines, or those ends are replaced [with a chapter of the 38th page - page / 48th] with an alkyl group, a sulfonic group, etc. can also

be preferably used as an electron injection material. Inorganic semiconductors, such as n type-Si and n type-SiC, as well as a hole injection layer can be used as an electron injection material.
[0131]This electronic injection layer can be produced, for example by a thin film-ized method a vacuum deposition method, a spin coat method, the cast method, the LB method, etc. are publicly known, and can form the above-mentioned compound.
[0132]As for thickness as an electronic injection layer, although there is no restriction in particular, it is preferred that they are 5 nm - about 5 micrometers.
[0133]An electronic injection layer may be one layer system containing the above-mentioned electron injection material kind or two sorts or more, or may be a laminated structure which has two or more layers of the same presentation or a different-species presentation.
[0134]Next, an inorganic system fluorescent substance and a rare earth complex system fluorescent substance in this invention are explained.
[0135]In this invention, if light is emitted to a maximum luminous wavelength which absorbs luminescence emitted from said electroluminescence material as an inorganic system fluorescent substance and a rare earth complex system fluorescent substance, and is different from a maximum luminous wavelength of this electroluminescence material, there will be no restriction in particular.
[0136]Here, a different luminous wavelength from a maximum luminous wavelength emitted from electroluminescence material says what not less than 10 nm of maximum luminous wavelengths of an inorganic system fluorescent substance left to a maximum luminous wavelength which electroluminescence material emits.
[0137]As for an inorganic system fluorescent substance or a rare earth complex system fluorescent substance contained in an electroluminescent element of this invention, it is preferred that it is what has the maximum luminescence to a 400-700-nm field by light emitted from electroluminescence material.
[0138]As for an inorganic system fluorescent substance or a rare earth complex system fluorescent substance contained in an electroluminescent element of this invention, it is preferred to contain at least one sort of things which have a maximum luminous wavelength in the not less than 180-nm long wave side to a maximum luminous wavelength emitted from electroluminescence material.
[0139]An electroluminescent element of this invention, At least one sort of an inorganic system fluorescent substance or a rare earth complex system fluorescent substance which has a maximum luminous wavelength in 400-500 nm for the purpose of full-color-izing by light emitted from electroluminescence material, It is preferred to have a color conversion layer which has at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in at least one sort of an inorganic system fluorescent substance which has a maximum luminous wavelength in 501-600 nm, or a rare earth complex system fluorescent substance, and 601-700 nm, or a rare earth complex system fluorescent substance, respectively.
[0140]The color conversion layer can take various gestalten by a use.
[0141]For example, it is not necessary to pattern especially in that case, and what is necessary is just to paint by uniform thickness, although a mixture of three sorts of fluorescent substances, blue light, green emission, and red light, is used to use a white surface state photogen, using a mixture of a fluorescent substance which emits light blue, and a fluorescent substance which emits light in yellow.
[0142]To obtain a multiple-color-ized color conversion filter like a light filter of a liquid crystal display. What is necessary is just to pattern a fluorescent substance in which the luminescent color to need is obtained after stripe shape, dot form, or mosaic shape, and as the patterning method, A manufacturing method of the conventional light filter for liquid crystal displays can apply as it is, and it can specifically create by a pigment dispersion method, print processes, the ink jet method, etc.
[0143]Y_2O_2S which is a crystal parent although a presentation of an inorganic system fluorescent substance in this invention does not have restriction in particular, A metallic oxide and ZnS which are represented by Zn_2SiO_4, $Ca_5(PO_4)_3Cl$, etc., What combined ion of metal, such as ion of rare earth metals, such as Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, and Yb, Ag, aluminum, Mn, In, Cu, and Sb, with a sulfide represented by SrS, CaS, etc. as an activator or a coactivator is preferred.
[0144]When a crystal parent is explained in more detail, as a crystal parent, a metallic oxide is preferred, For example, $(X)_3aluminum_{16}O_{27}$, $(X)_4aluminum_{14}O_{25}$, $(X)_3aluminum_2Si_2O_{10}$, $(X)_4Si_2O_8$, $(X)_2Si_2O_6$, $(X)_2P_2O_7$, $(X)_2P_2O_5$, $(X)_5(PO_4)_3Cl$, and $(X)_2Si_3O_8$-2(X)Cl_2[Here, X expresses alkaline-earth metals. Single components or two or more kinds of mixed ingredients may be sufficient as alkaline-earth metals expressed with X, and the mixing ratio may be arbitrary. An aluminum oxide, silicon oxide, phosphoric acid, halo phosphoric acid, etc. which were replaced with alkaline-earth metals like] are mentioned as a typical crystal parent.
[0145]As other desirable crystal parents, zincky oxide and sulfide, yttrium, and GADORIUMU, What blended arbitrary metallic elements with sulfides, and those oxides and sulfides of a thing (sulfide) which changed a part of oxide of rare earth metals, such as a lantern, and oxygen of the oxide to a sulfur atom, and a rare earth metal is mentioned.
[0146]Desirable examples of a crystal parent are enumerated below.
[0147]ZnS, Y_2O_2S, $Y_3aluminum_5O_{12}$, Y_2SiO_{10}, Zn_2SiO_4, Y_2O_3, $BaMgAl_{10}O_{17}$, $BaAl_{12}O_{19}$, O-aAl(Ba, Sr, Mg)$_2O_3$, (Y, Gd)BO_3, S (Zn, Cd), $SrGa_2S_4$, SrS, GaS, SnO_2, and $Ca_{10}(PO_4)_6$ (F.) Cl)$_2$, aluminum(Mg (Ba, Sr), Mn)$_{10}O_{17}$, (Sr, Ca, Ba, Mg)$_{10}(PO_4)_6Cl_2$, (La, Ce)PO_4, $CeMgAl_{11}O_{19}$, $GdMgB_5O_{10}$, $Sr_2P_2O_7$, They are $Sr_4aluminum_{14}O_{25}$, Y_2SO_4, Gd_2O_2S, Gd_2O_3, YVO_4, Y(P, V)O_4, etc.
[0148]What is necessary is for what was replaced with an element of the same family in part to be sufficient as the above crystal parent and activator, or coactivator, and for there to be no restriction in particular in elementary composition, to absorb light of an ultraviolet region, or light of a purple field, and just to emit visible light.
[0149]In this invention, a thing desirable as an activator of an inorganic fluorescent substance and a coactivator, Metal of ion of a lanthanoids represented by La, Eu, Tb, Ce, Yb, Pr, etc., Ag, Mn, Cu, In, aluminum, etc. It is ion, and 0.001-100-mol% of the doped quantity is desirable to a parent, and is still more desirable. [0.01-50 mol% of]
[0150]An activator and a coactivator are doped in the crystal by transposing some ion which constitutes a crystal parent to ion like the above-mentioned lanthanoids.
[0151]If a actual presentation of a fluorescent substance crystal is indicated strictly, it will become the following empirical

formulas, but since size of quantity of an activator does not affect an essential fluorescent characteristic in many cases, as long as there is no notice, suppose below that a numerical value of following x or y is not indicated especially. For example, Sr_{4-x}aluminum$_{14}O_{25}:Eu^{2+}_{x}$ writes it as Sr_4aluminum$_{14}O_{25}:Eu^{2+}$ in this invention.

[0152]Although an empirical formula of a typical inorganic fluorescent substance (a crystal parent and an inorganic fluorescent substance constituted with an activator) is indicated below, this invention is not limited to these. $(Ba_zMg_{1-z})_{3-x-y}$aluminum$_{16}O_{27}:Eu^{2+}_{x}$, Mn^{2+}_{y}, Sr_{4-x}aluminum$_{14}O_{25}:Eu^{2+}_{x}$, $(Sr_{1-z}Ba_z)_{1-x}$aluminum$_2Si_2O_8:Eu^{2+}_{x}$, $Ba_{2-x}SiO_4:Eu^{2+}_{x}$, $Sr_{2-x}SiO_4:Eu^{2+}_{x}$, $Mg_{2-x}SiO_4:Eu^{2+}_{x}$, $_{1-x}$(BaSr) SiO4:Eu^{2+}_{x}, $Y_{2-x-y}SiO_5:Ce^{3+}_{x}$, Tb^{3+}_{y}, $Sr_{2-x}P_2O_5:Eu^{2+}_{x}$, $Sr_{2-x}P_2O_7:Eu^{2+}_{x}$, $_{5-x}(Ba_yCa_zMg_{1-y-z})(PO_4)_3Cl:Eu^{2+}_{x}$, $Sr_{2-x}Si_3O_8-2SrCl_2:Eu^{2+}_{x}$[x, y, and z express one or less arbitrary numbers, respectively.]

Although an inorganic fluorescent substance preferably used for below by this invention is shown, this invention is not limited to these compounds.

[Blue light inorganic matter fluorescent compound]

(BL-1) $Sr_2P_2O_7:Sn^{4+}$ (BL-2) Sr_4aluminum$_{14}O_{25}:Eu^{2+}$ (BL-3) $BaMgAl_{10}O_{17}:Eu^{2+}$ (BL-4). $SrGa_2S_4:Ce^{3+}$ (BL-5) $CaGa_2S_4:Ce^{3+}$(BL-6) aluminum(Mg (Ba, Sr), Mn) $_{10}O_{17}:Eu^{2+}$ (BL-7) (Sr and Ca —) [Ba and] Mg) $_{10}(PO_4)_6Cl_2:Eu^{2+}$ (BL-8) $BaAl_2SiO_8:Eu^{2+}$ (BL-9) $Sr_2P_2O_7:Eu^{2+}$ (BL-10). Sr_5. $(PO_4)_3Cl:Eu^{2+}$(BL-11) $_5$(Sr, Ca, Ba) $(PO_4)_3Cl:Eu^{2+}$ (BL-12) $BaMg_2$aluminum$_{16}O_{27}:Eu^{2+}$ (BL-13). (Ba, Ca) $_5(PO_4)_3Cl:Eu^{2+}$ (BL-14) $Ba_3MgSi_2O_8:Eu^{2+}$ (BL-15) $Sr_3MgSi_2O_8:Eu^{2+}$[green emission inorganic matter fluorescent compound]

(GL-1) (.) BaMgaluminum$_{16}O_{27}:Eu^{2+}$ and Mn^{2+} (GL-2) Sr_4aluminum$_{14}O_{25}:Eu^{2+}$ (GL-3) (SrBa)aluminum$_2Si_2O_8:Eu^{2+}$ (GL-4). (BaMg) $_2SiO_4:Eu^{2+}$. (GL-5). $Y_2SiO_5:Ce^{3+}$, Tb^{3+}. (GL-6) $Sr_2P_2O_7-Sr_2B_2O_5:Eu^{2+}$ (GL-7) $(BaCaMg)_5(PO_4)_3Cl:Eu^{2+}$ (GL-8). $Sr_2Si_3O_8-2SrCl_2:Eu^{2+}$ (GL-9) Zr_2SiO_4, $MgAl_{11}O_{19}$:. Ce^{3+}, Tb^{3+} (GL-10) $Ba_2SiO_4:Eu^{2+}$ (GL-11) $Sr_2SiO_4:Eu^{2+}$ (GL-12) (BaSr) $SiO_4:Eu^{2+}$[red light inorganic matter fluorescent compound]

(RL-1). $Y_2O_2S:Eu^{3+}$ (RL-2). $YAlO_3:Eu^{3+}$ (RL-3). $Ca_2Y_2(SiO_4)_6:Eu^{3+}$ (RL-4) $LiY_9(SiO_4)_6O_2:Eu^{3+}$ (RL-5) $YVO_4:Eu^{3+}$ (RL-6). An inorganic fluorescent substance used for $CaS:Eu^{3+}$ (RL-7) $Gd_2O_3:Eu^{3+}$ (RL-8) $Gd_2O_2S:Eu^{3+}$ (RL-9) $Y(P, V)O_4:Eu^{3+}$ this invention from a viewpoint of luminescence intensity. It does not pass through a mechanical disruption process at the time of manufacture, i.e., what is compounded by the build up method is preferred, and what is manufactured by a liquid phase process especially by the Sol-Gel method etc. is preferred. A presentation top has that preferred from which an inorganic oxide serves as a parent.

[0153]Although written to the Sumio Sakuhana work "application of a sol-gel method" (company issue of the 1997 AGUNE ** style) as a manufacturing method by the Sol-Gel method in detail, for example, With the "Sol-Gel method" as used in the field of [fundamentally, leaves a solution, means how to compound material at low temperature rather than scorification through solation of a solution, and gelling, and] this invention. It can point out performing a reaction in a liquid phase process at at least 1 process of fluorescent substance manufacture, and can distinguish from a synthetic method performed at a melting reaction applied to the usual inorganic fluorescent substance composition. The Sol-Gel method of this invention, They are for example, a tetramethoxy silane $(Si(OCH_3)_4)$ and europium 2,4-pentane JIONETO $(Eu^{3+}$ $(CH_3COCH=C(O^{-}))_3)$ about an element (metal) generally used for a parent, an activator, or a coactivator. - A double alkoxide which adds and makes a metal simple substance to metal alkoxides, such as CH_{33}, metal complexes, or those organic solvent solutions (for example, Mg which adds and makes metal magnesium in a 2-butanol solution of aluminum(OBu) $_3$) [aluminum(OBu) $_3$] $_2$ etc. carry out initial-complement mixing as a metal halogenide, metal salt of organic acid, and a metal simple substance, a manufacturing method by carrying out a polycondensation thermally or chemically by a liquid phase state is meant, and calcination, reduction processing, etc. may be performed if needed.

[0154]With "metal" of a metal alkoxide, a metal halogenide and metal salt which are used by this invention, or metal. All the elements of "a transition metal (Transition Metals)", [others / "the metal (Metals)" generally defined by the periodic table etc.] A definition is given as a thing having contained all the elements of a "lanthanoids", all the elements of "actinoid" and boron defined as "a nonmetal (Non Metals)", and silicon (silicon).

[0155]The above-mentioned inorganic fluorescent substance may perform surface treatment processing if needed, and what is depended on physical processing by addition of what is depended on chemical preparation, such as a silane coupling agent, as the method, particles of a submicron order, etc., a thing further depended on those concomitant use, etc. are mentioned.

[0156]As a silane coupling agent used by this invention, Can use as it is what is written in a "NUC silicone silane coupling agent" catalog of the Nippon Unicar, Inc. issue (August 2, 1997), and as the example, For example, beta -(3,4-epoxycyclohexyl)- Ethyl trialkoxysilane, Glycidyloxy ethyltriethoxysilane, a gamma-acryloyloxy n-propyltri-n-propyloxy silane, A gamma-methacryloyloxy n-propyl-n-propyloxy silane, A JI (gamma-acryloyloxy n-propyl) di-n-propyloxy silane, An acryloyloxy dimethoxyethylsilane, N-beta (aminoethyl) gamma-aminopropyl trimethoxysilane, N-beta (aminoethyl) gamma-aminopropyl methyl dimethoxysilane, gamma-aminopropyl triethoxysilane, N-phenyl-gamma-aminopropyl trimethoxysilane, gamma-mercapto propyltrimethoxysilane, etc. are mentioned.

[0157]As particles used by this invention, it is preferred that they are inorganic particles, for example, particles, such as silica, a titania, zirconia, and a zinc oxide, are mentioned.

[0158]When manufacturing especially by the Sol-Gel method, after patterning liquid containing a precursive solution or a primary particle of a fluorescent substance after a transparent substrate by print processes, the ink jet method, etc., crystallization treatment, such as calcination and reduction processing, or rise-in-luminosity processing may be performed.

[0159]Next, as a rare earth complex system fluorescent substance in this invention, As an organic ligand which what has Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, etc. as a rare earth metal is mentioned, and forms a complex, A compound which either an aromatic

system or a non-aromatic system is OK as, and is preferably expressed with a following general formula (1) or a general formula (R2) is preferred.

[0160]General formula (1)

The inside of a Xa-(La)-(Lb)n-(Lc)-Ya[type, La, Lb, Lc expresses an atom which has two or more joint hands independently, respectively, n expresses 0 or 1, Xa expresses a substituent which has an atom which can be configurated at least in contiguity of La, and Ya expresses a substituent which has an atom which can be configurated at least in contiguity of Lc. Furthermore arbitrary portions and La of Xa are condensed mutually, a ring may be formed, arbitrary portions and Lc(s) of Ya are condensed mutually, a ring may be formed, La and Lc are condensed mutually, a ring may be formed, and aromatic hydrocarbon rings or at least one aromatic heterocycle exists in intramolecular further. Xa-(La)-(Lb)n-(Lc)-Ya However, beta-diketone derivative and beta-ketoester derivative, What transposed a beta-keto amide derivative or an oxygen atom of said ketone to a sulfur atom or -N(R1)-, When it expresses crown ether which transposed an oxygen atom of crown ether, azacrown ether, thia crown ether, or crown ether to arbitrary number sulfur atoms or -N(R1)-, there may not be aromatic hydrocarbon rings or an aromatic heterocycle.]

In a general formula (1), it is preferred that atoms which are expressed with Xa and Ya and which can be configurated are specifically an oxygen atom, a nitrogen atom, a sulfur atom, a selenium atom, and a tellurium atom, and are especially an oxygen atom, a nitrogen atom, and a sulfur atom.

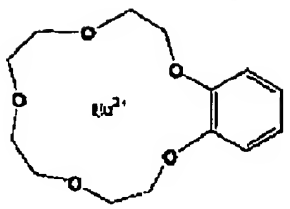
[0161]although there is no restriction in particular as an atom which has two or more joint hands of being expressed with La, Lb, and Lc, in a general formula (1) and a carbon atom, an oxygen atom, a nitrogen atom, a silicon atom, a titanium atom, etc. are mentioned typically — this — better — that of a potato is a carbon atom.

[0162]Although an example of a rare earth complex system fluorescent substance expressed with a general formula (1) below is shown, this invention is not limited to these.

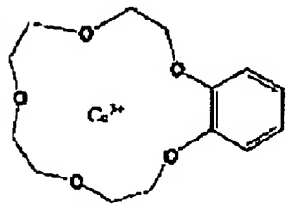
[0163]

[Formula 54]

RE-1



RE-2



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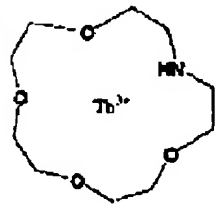

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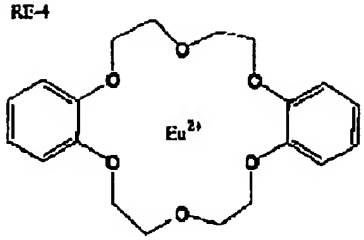

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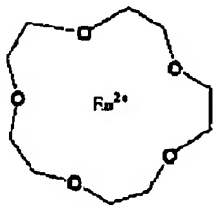

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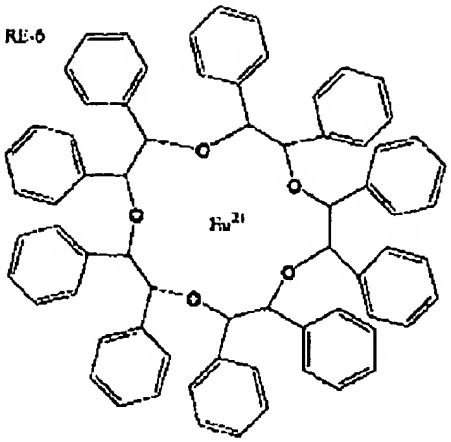

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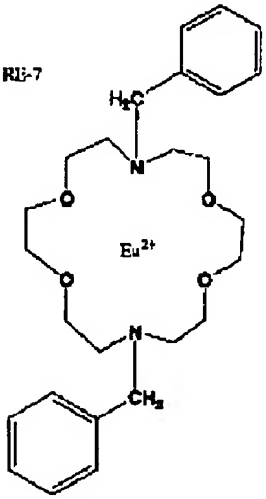

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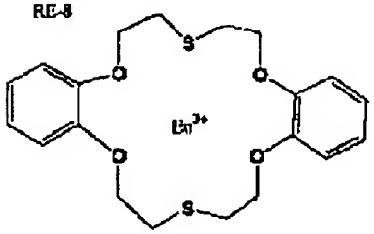
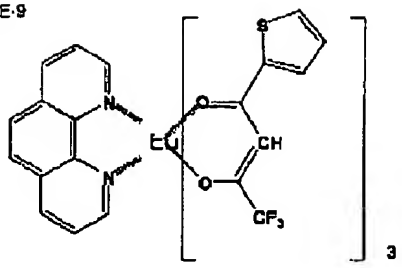


[0164]

[Formula 55]

RE-9



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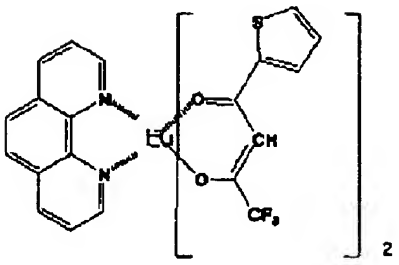

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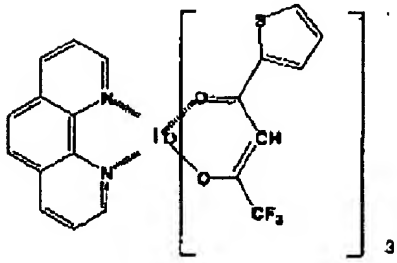

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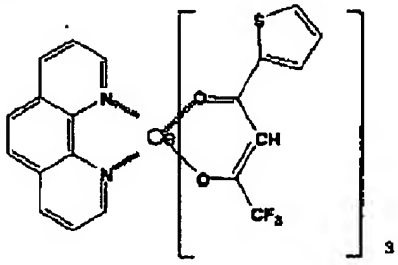

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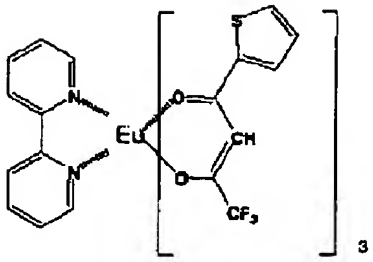

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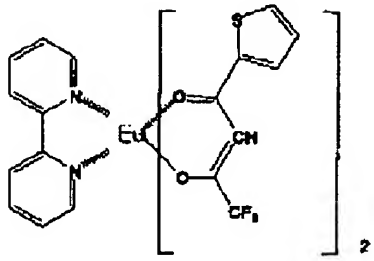

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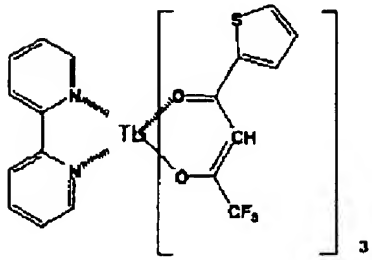

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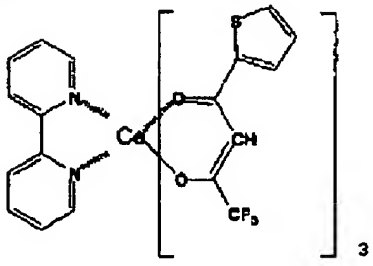
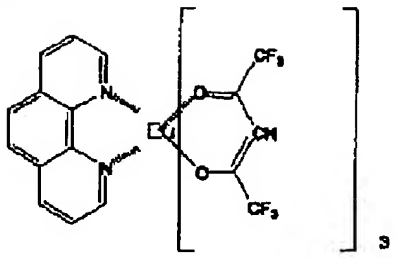


[0165]

[Formula 56]

RE-17



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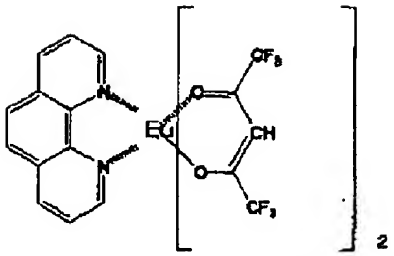

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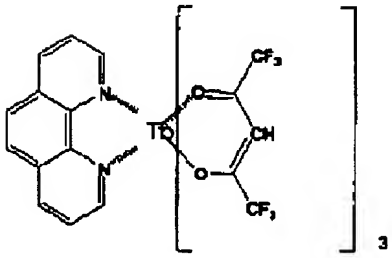

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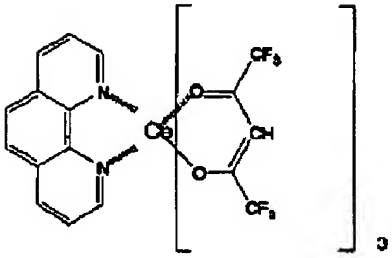

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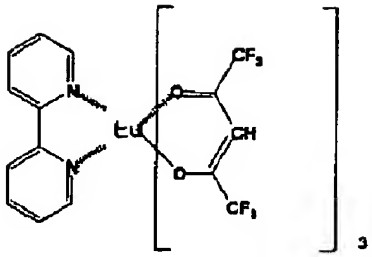

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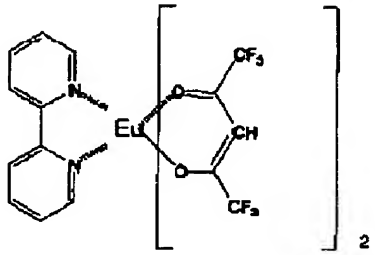

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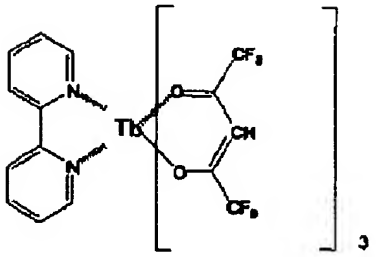

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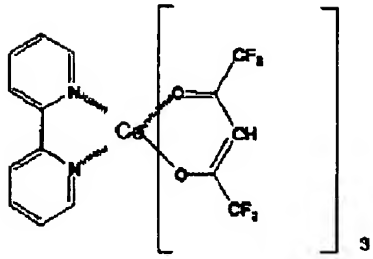
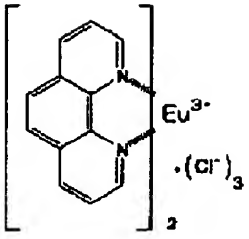


[0166]

[Formula 57]

RE-25



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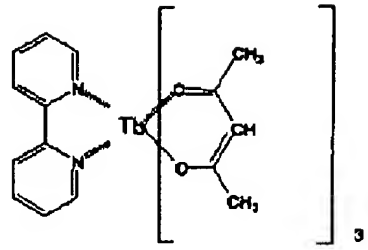

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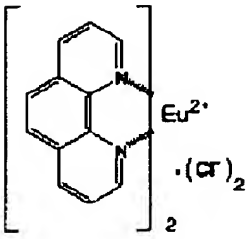

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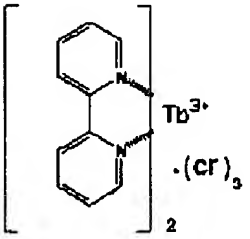

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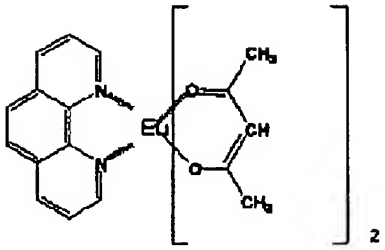
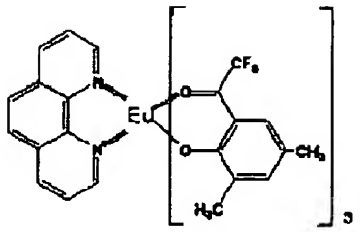


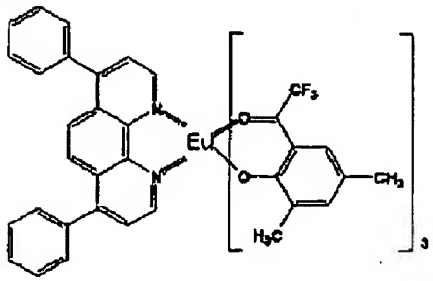
[0167]

[Formula 58]

RF-1



RF-2



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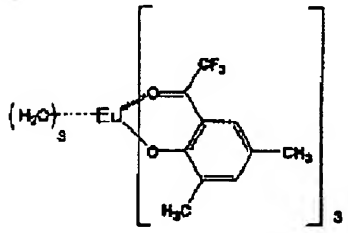

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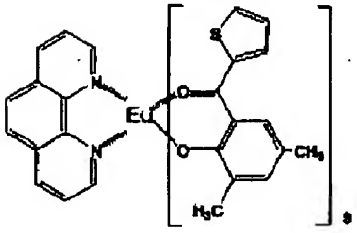

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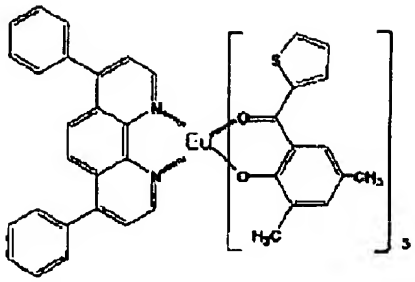
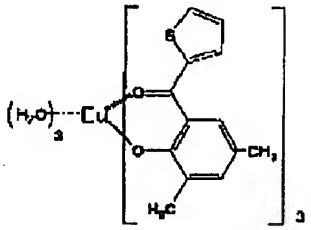
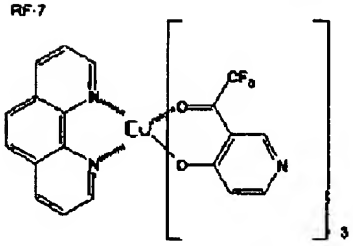


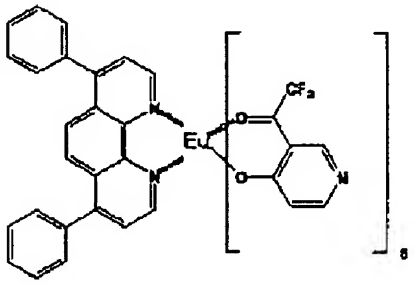
RF-6



RF-7



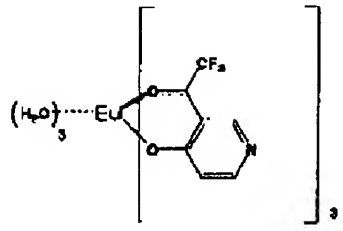
RF-8



[0168]

[Formula 59]

RF-9



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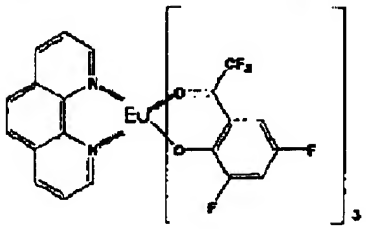

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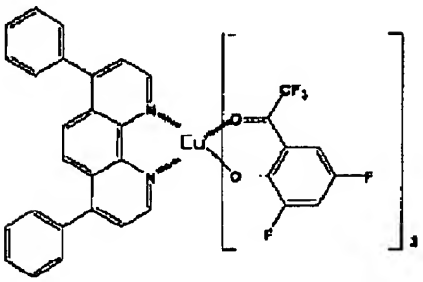
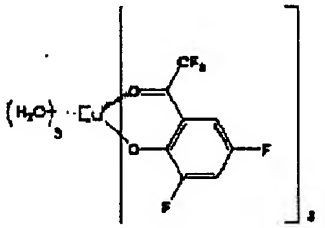
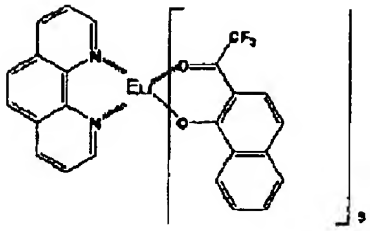


RF-12



RF-13



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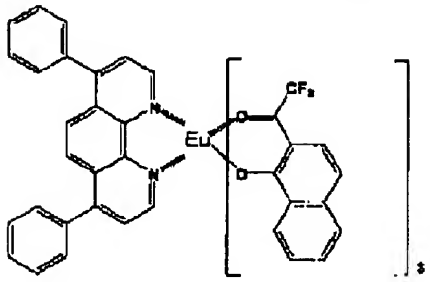

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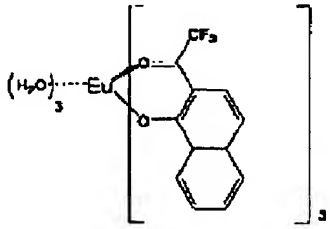
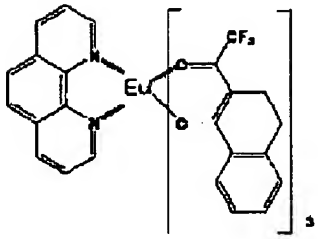


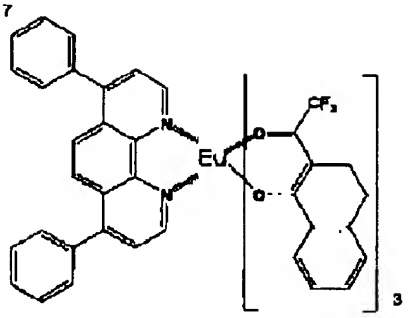
RF-16



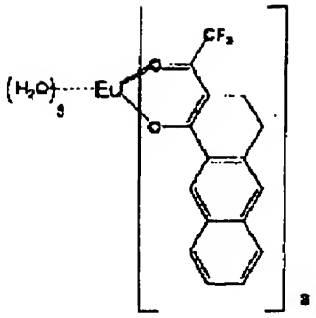
[0169]

[Formula 60]

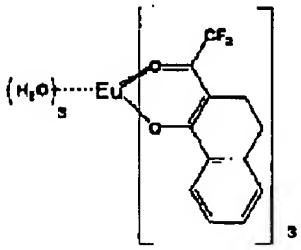
RF-17



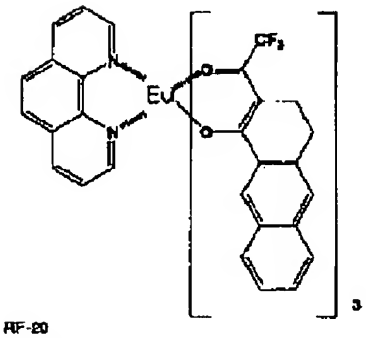
RF-21



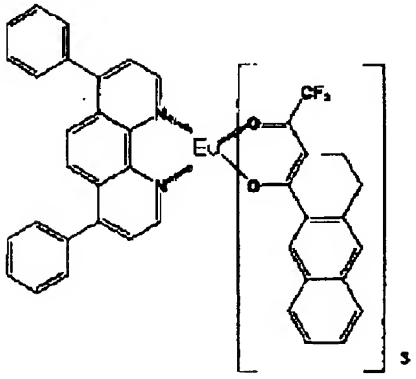
RF-18



RF-19



RF-20



[0170]Next, the color conversion filter in this invention is explained.

[0171]The color conversion filter as used in the field of this invention is a wavelength changing element used for changing the color (luminescent color) of a light source into a desired color, Fundamentally, rather than the maximum maximum wavelength of a light source, are a wavelength changing element which can change wavelength into not less than 10-nm long wavelength, and as a concrete use, The filter for full color displays indicated to JP,3-152897,A, 9-245511, 11-297477, etc. (in green and red from a blue light source) [change and] The color conversion filter which enables luminescence of blue, green, and red by arranging them to stripe shape, The filter for white light for the back lights of lighting or a liquid crystal display (color conversion filter which makes the light of a 400-700-nm visible region emit light broadly), A neon sign, the filter for partial luminescence of the instruments of a car (color conversion filter for displaying a color required for a place as occasion demands), etc. are mentioned as the example of representation.

[Translation done.]

EXAMPLE

[Example]Although an example is given and this invention is explained in detail hereafter, the mode of this invention is not limited to this.

[0173]After patterning after the substrate (NA-45 by a NH techno glass company) which formed 150 nm of ITO(s) on glass as the production anode of an EXAMPLE (1-1) electroluminescent element (UV-1), The transparent supporting board which provided this ITO transparent electrode was cleaned ultrasonically with isopropyl alcohol, it dried with dry nitrogen gas, and UV ozone wash was performed for 5 minutes. This transparent supporting board is fixed to the substrate holder of a commercial vacuum evaporator, and, on the other hand, it is a N,N'-diphenyl-N,N'-screw (3-methylphenyl) to the resistance heating boat made from molybdenum. [1,1'-biphenyl] -Put in 200 mg of 4,4'-diamine (TPD), and 200 mg of p-KUUO terphenyl (PQP) is put into another resistance heating boat made from molybdenum, 200 mg of tris(8-hydroxyquinolinate)aluminium (Alq_3) was put into another resistance heating boat made from molybdenum, and it attached to the vacuum evaporator.

Subsequently, after decompressing a vacuum chamber to $4x10^{-4}$Pa, it energized to said heating boat containing TPD, heated to 220 **, and vapor-deposited to the transparent supporting board with the evaporation rate of 0.1-0.3nm/sec, and the hole injection layer of 60 nm of thickness was formed. Said heating boat containing PQP was energized, and it heated to 220 **, it vapor-deposited on said hole injection layer with the evaporation rate of 0.1-0.3nm/sec, and the luminous layer of 40 nm of thickness was provided. Said heating boat containing Alq_3 was energized, and it heated to 250 **, it vapor-deposited on said luminous layer with the evaporation rate of 0.1nm/sec, and the electronic injection layer of 20 nm of thickness was formed. The substrate temperature at the time of vacuum evaporation was a room temperature. Next, open a vacuum chamber and the rectangular-holes vacancy mask made from stainless steel is installed on an electronic injection layer, On the other hand, put the magnesium 3g into the resistance heating boat made from molybdenum, and 0.5g of silver is put into the basket for vacuum evaporation made from tungsten, After decompressing a vacuum chamber to $2x10^{-4}$Pa again, energize on the boat containing magnesium and magnesium is vapor-deposited with the evaporation rate of 1.5-2.0nm/sec, Under the present circumstances, electroluminescent element UV-1 was produced by heating a silver basket simultaneously, vapor-depositing silver with the evaporation rate of 0.1nm/sec, and considering it as the counterelectrode which consists of a mixture of said magnesium and silver.

[0174]When 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver, luminescence with a luminescence maximum wavelength of 380 nm was obtained.

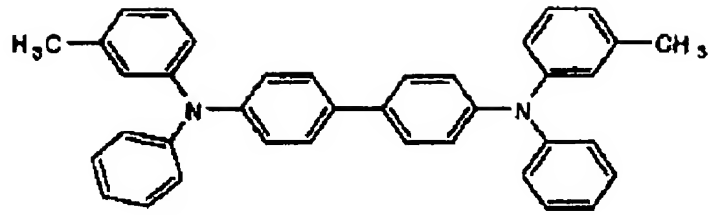
[0175]An example. (1-2) . The electroluminescent element for comparison. The electroluminescent element for comparison (B-1) produced by the completely same method as (1-1) was produced except having transposed photogen p-KUUO terphenyl (PQP) of production (1-1) of (B-1) to 4,4'-bis(2,2'-diphenylvinyl)biphenyl (DPVBi).

[0176]When 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver, blue luminescence with a luminescence maximum wavelength of 475 nm was obtained.

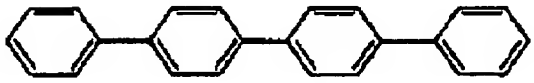
[0177]

[Formula 61]

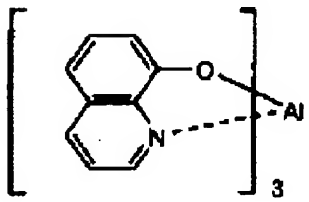
TPD



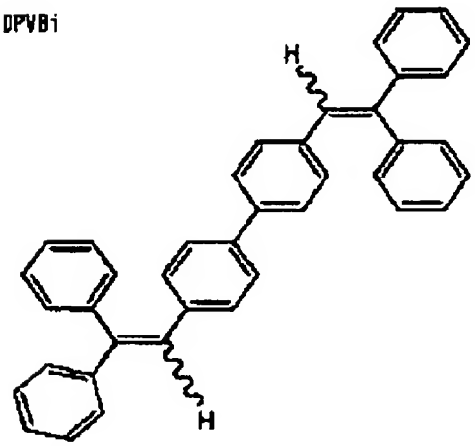
PQP



Alq3



DPVBi



[0178]EXAMPLE (2-1) 150 ml of ethanol and 150 ml of water were added to the ammonia solution containing ammonia of 0.016 mol of composition of illustration compound (GL-10) $Ba_2SiO_4:Eu^{2+}$, and lye was produced.

[0179]Furthermore, 8.33g of tetraethoxysilanes. adding stirring the solution which dissolved (0.04 mol) and the europium (III) acetylacetonato complex 2 hydrate 0.097g (0.2 millimol) in 150 ml of ethanol by dropping speed about 1 ml/min in said lye under a room temperature — sol — liquid was adjusted. The obtained sol is condensed about 15 times (about 30 ml) by an evaporator, 295 ml added to this and it was made to gel the barium nitrate solution of 0.3 mol/l.

[0180]The obtained moist gel was ripened at 60 ** among the well-closed container overnight. Stirring distribution was carried out into ethanol (about 300 ml) after that, and it isolated preparatively by the suction filtration using a filter paper (Advantec 5A), and dried at the room temperature. Inorganic fluorescent substance which dry gel performs heat treatment at 1000 ** among H2-N2 atmosphere 5% for 2 hours, and shines in thin green under sunlight GL-10 ($Ba_2SiO_4:Eu^{2+}_{0.005}$) 2.7g was obtained.

[0181]The XRD spectrum analyzed the component composition of GL-10. It turned out that the main ingredients are Ba_2SiO_4 and the accessory constituents contained in very small quantities are $BaSiO_3$ and Ba_3SiO_5 as a result.

[0182]It turned out that it is a fluorescent substance in which the mean particle diameter of GL-10 emits light in 1.05-micrometer green, and a luminescence maximum wavelength emits light in 500 nm (405 nm of excitation light) green.

[0183]The red light particle inorganic fluorescent substance (RL-5) (the mean particle diameter of about 0.85 micrometer, maximum luminous wavelength of 610 nm (375 nm of excitation light)) and the blue light inorganic fluorescent substance (BL-3) (the mean particle diameter of 0.90 micrometer, maximum luminous wavelength of 432 nm (375 nm of excitation light)) were obtained in the similar way.

[0184]EXAMPLE (2-2) 15g of ethanol and 0.22 g of gamma **GURISHIDOKI Cipro pill triethoxysilane were added to 0.16 g of Aerosil with a surface physical property refining mean particle diameter of 5 nm of a particle inorganic fluorescent substance, and it stirred under the open system room temperature for 1 hour. moving these mixture and 20 g of inorganic fluorescent substances (GL-10) to a mortar, and often heating in 120 more ** oven in 70 ** oven after pickpocket ****** for 2 hours for 2 hours — surface treatment — having carried out (GL-10) — it obtained.
[0185]Surface treatment of RL-5 and BL-3 was performed similarly.
[0186]the inorganic fluorescent substance (RL-5) of surface physical property improvement this invention of an EXAMPLE (2-3) comparison inorganic fluorescent substance — KX-605 ($Zn_2SiO_4:Mn^{2+}$,) by Kasei Optonix, Ltd. Surface treatment of KX-605 was performed by the completely same method as the method of the above-mentioned (2-2) statement except having transposed to the mean particle diameter of 7 micrometers, and the maximum luminous wavelength of 570 nm (343 nm of excitation light).
[0187]EXAMPLE (3-1) to 10 g of red light inorganic fluorescent substances (RL-5) of this invention which gave surface treatment of the production above of the color conversion filter using an inorganic fluorescent substance. After adding and stirring 30 g of butyral (BX-1) dissolved with the mixed solution (300g) of toluene/ethanol =1/1, it applied on glass by 200 micrometers of Wet thickness. Stoving of the obtained applied glass was carried out in 100 ** oven for 4 hours, and the color conversion filter (F-1) of this invention was created.
[0188]The color conversion filter (F-3) which painted the color conversion filter (F-2) and blue light inorganic fluorescent substance (BL-3) which painted the green emission inorganic fluorescent substance (GL-10) by the same method as this was created.
[0189]The convert-colors light filter for comparison (F-4) which painted comparison inorganic fluorescent substance KX-605 (what performed surface treatment processing) in the similar way was created.
[0190]To color conversion filter F-1 of this invention, F-2, and F-3 being transparent filters almost in colorlessness, the comparative color conversion filter F-4 became muddy white, and did not almost have a light transmittance state.
[0191]As for visible light transmittance, in F-2, F-3 was [F-1 / F-4] 4% 57% 57% 54%.
[0192]EXAMPLE (3-2) 3 g of rare earth complex system fluorescent substances (RE-17) of this invention are dissolved in 30 g of butyral (BX-1) dissolved with the mixed solution (300g) of creation toluene / ethanol =1/1 of the color conversion filter using a rare earth complex system fluorescent substance, Warm air desiccation was applied and carried out by 150 micrometers of Wet thickness on the 80-micrometer-thick polyether sulphone (PES) film, and the color conversion filter (F-5) of the red light of this invention was created.
[0193]Like this, RE-23 was used instead of RE-17 and the color conversion filter (F-6) of the green emission of this invention was created.
[0194]RE-1 was used instead of RE-17 and the color conversion filter (F-7) of the blue light of this invention was created.
[0195]EXAMPLE (3-3) Creation of the color conversion filter using a fluorochrome (comparison)
It is a fluorochrome instead of RE-17 of the above (3-2). Coumarin 6 2.0 g and fluorescent pigment solvent yellow 116 The color conversion filter (F-8) of the blue optical-pumping green emission which is compared by the same method as (3-2) was created except having changed to 0.5 g.
[0196]The fluorescent pigment solvent yellow 116 instead of RE-17 of (3-2) 1.0 g, The color conversion filter (F-9) of the blue optical-pumping red light which is compared by the same method as (3-2) about the basic violet 11 except having changed 0.5g and rhodamine 6G to 0.5 g was created.
[0197]When the electroluminescent element (UV-1) produced by (1-1) and the color conversion filter (F-1) produced by (3-1) are piled up and 12V direct current voltage is applied under a dry nitrogen gas atmosphere, the luminosity which emits light from a color conversion filter is 26 cd/m^2.
It observed that red (red) luminescence had come out of a CIE chromaticity coordinate by x= 0.64 and y= 0.29.

[0198]EXAMPLE (4-1) (evaluation of the luminous efficiency of an electroluminescent element, a life, and a color tone)
Put the color conversion filter of this invention, or a comparative color conversion filter on each of an electroluminescent element (UV-1) and the electroluminescent element for comparison (B-1) so that a fluorescent substance layer may face the light-emitting surface of an electroluminescent element, and The temperature of 23 **, The continuous light by 12V direct-current-voltage impression was performed under a dry nitrogen gas atmosphere, and time to halve the luminous efficiency (lm/W) at the time of a lighting start and luminosity was measured. Luminous efficiency was expressed with the relative value when luminous efficiency of sample No.7 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.8 to 100. A result is shown in Table 1.
[0199]
[Table 1]

No.	エレクトロルミネッセンス素子	色変換フィルター	発光効率（相対値）	発光色	連続発光後の輝度半減時間（相対値）	備考
1	UV-1	F-1	71	赤	169	本発明
2	UV-1	F-5	68	赤	156	本発明
3	B-1	F-9	25	赤	103	比較例
4	UV-1	F-2	165	緑	186	本発明
5	UV-1	F-4	15	緑	161	比較例
6	UV-1	F-6	155	緑	162	本発明
7	B-1	F-8	100	青	100	比較例
8	UV-1	F-3	111	青	186	本発明
9	UV-1	F-7	108	青	169	本発明

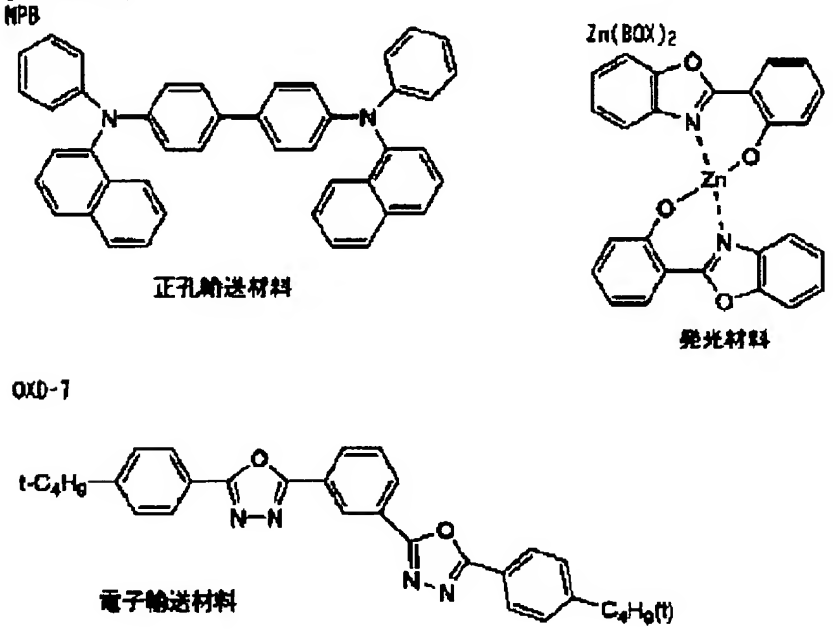
[0200]From Table 1, compared with sample No.3 of comparison, luminous efficiency is high and the electroluminescent element (sample No.1 and 2) which has a color conversion filter of this invention which emits light in red found a long time also for the life. Furthermore, the luminescent color was also a color tone with the more preferred sample of this invention.

[0201]The electroluminescent element (sample No.4 and 6) which has a color conversion filter of this invention which emits light green was understood that luminous efficiency is overwhelmingly high compared with sample No.5 of comparison which uses the conventional inorganic system fluorescent substance for a color conversion filter. Even if compared with sample No.7 which is furthermore the combination of the electroluminescent element of blue light, and a color conversion filter, luminous efficiency was high and the life also found a long time. It was a color tone whose luminescent color is also still more preferred than a comparison sample.
[0202]Also in sample No.8 of this invention which emits light still bluer, and 9, high luminous efficiency and high temporal stability were checked.
[0203]EXAMPLE (5-1) (evaluation of a LED element)
When voltage was applied in piles, respectively and light was emitted in the color conversion filter (F-1) of this invention, and (F-5) so that a fluorescent substance layer might approach the LED element side at the ultraviolet luminescence LED element by Nichia Chemical Industries, Ltd. (UV LED Lamp), luminosity and a color tone emitted good red light. When voltage was applied in piles, respectively and light was similarly emitted in the color conversion filter (F-2) of this invention, and (F-6), luminosity and a color tone emitted good green light. When voltage was applied in piles, respectively and light was similarly emitted in the color conversion filter (F-3) of this invention, and (F-7), luminosity and a color tone emitted good blue glow.
[0204]EXAMPLE (6-1) the compound N-7 of this invention. The electroluminescent element for comparison (S-N7) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-N7) to the compound N-7 of this invention. It produced.
[0205]Purple luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.
[0206]EXAMPLE (6-2) compound-A-3 of this invention. The electroluminescent element for comparison (S-A3) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-A3) to compound-A-3 of this invention. It produced.
[0207]When 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver, luminescence of the lavender color was obtained.
[0208]EXAMPLE (6-3) the compound B-1 of this invention. The electroluminescent element for comparison (S-B1) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-B1) to the compound B-1 of this invention. It produced.
[0209]Purple luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.
[0210]EXAMPLE (6-4) the compound D-5 of this invention. The electroluminescent element for comparison (S-D5) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-D5) to the compound D-5 of this invention. It produced.
[0211]Purple luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.
[0212]EXAMPLE (6-5) compound-F-1 of this invention. The electroluminescent element for comparison (S-F1) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-F1) to compound-F-1 of this invention. It produced.
[0213]Purple luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.
[0214]EXAMPLE (7-1) (near-ultraviolet [of this invention] - evaluation of a purple luminescent compound)
As the electroluminescent element of near-ultraviolet [which was created by above-mentioned example (6-1) - (6-5)] - purple luminescence, and its comparison. It is a color conversion filter of this invention to each of the electroluminescent element (UV-1) created using the conventional luminescent material created by EXAMPLE (1-1). Pile up F-2 so that a fluorescent substance layer may face the light-emitting surface of an electroluminescent element, and Temperature of 23 **, The continuous light by 15V direct-current-voltage impression was performed under a dry nitrogen gas atmosphere, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.701 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.701 to 100. A result is shown in Table 2.
[0215]
[Table 2]

No.	エレクトロルミネッセンス素子	色変換フィルター	発光輝度(相対値)	発光色	連続発光後の輝度半減時間(相対値)	備考
701	UV-1	F-2	100	緑	100	本発明
702	S-N7	F-2	178	緑	227	本発明
703	S-A3	F-2	456	緑	340	比較例
704	S-B1	F-2	320	緑	270	本発明
705	S-D5	F-2	540	緑	215	比較例
706	S-F1	F-2	312	緑	359	本発明

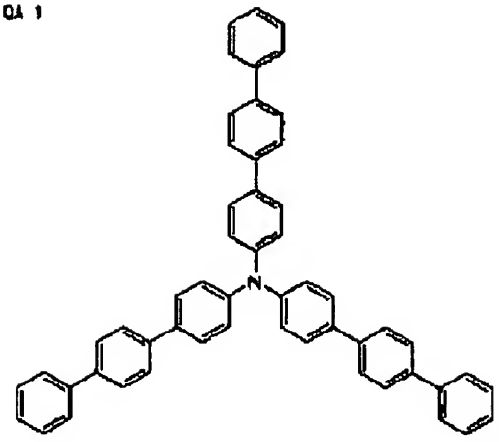
[0216]The electroluminescent element (S-N7, S-A3, S-B1, S-D5, S-F1) which uses the luminescent compound (N-1, A-3, B-1, D-5, F-1) of this invention so that more clearly than Table 2, Compared with the electroluminescent element (UV-1) using the conventional luminescent compound, the light emitting luminance at the time of using the same color conversion filter was dramatically high, and it turned out that a life is also improved further substantially.
[0217](Production of the electroluminescent element which uses the compound of this invention which emits light to a visible

region)
EXAMPLE (8-1) the compound C-8 of this invention. The electroluminescent element for comparison (S-C8) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-C8) to the compound C-8 of this invention. It produced.
[0218]When 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver, luminescence of blue-green was obtained.
[0219]EXAMPLE (8-2) compound-E-1 of this invention. The electroluminescent element for comparison (S-E1) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-E1) to compound-E-1 of this invention. It produced.
[0220]Green luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.
[0221]EXAMPLE (8-3) compound-F-7 of this invention. The electroluminescent element for comparison (S-F7) produced by the completely same method as an example (1-1) except having transposed photogen p-KUUO terphenyl (PQP) of the production examples (1-1) of the used electroluminescent element (S-F7) to compound-F-7 of this invention. It produced.
[0222]Blue luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.
[0223](Performance comparison with the compound of this invention, and the publicly known analogue)
EXAMPLE (9-1) — the electroluminescent element of composition of being shown in Drawing 101 was produced using the same method as the production examples (1-1) of a comparative electroluminescent element (CF-1).
[0224]By a thickness of 70 nm, for NPB Zn(BOX) 2 to the electron hole transporting bed of the 1st layer at the luminous layer of the 2nd layer by a thickness of 50 nm. Electroluminescent element CF-1 of comparison was produced by the completely same technique as the electroluminescent element (UV-1) of an example (1-1) except having laminated OXD-7 by a thickness of 30 nm to the electron transport layer of the 3rd layer.
[0225]Blue luminescence was obtained when 10 volts of direct current were impressed by using as the negative pole the counterelectrode which consists the ITO electrode of this element of the anode, magnesium, and silver.
[0226]
[Formula 62]



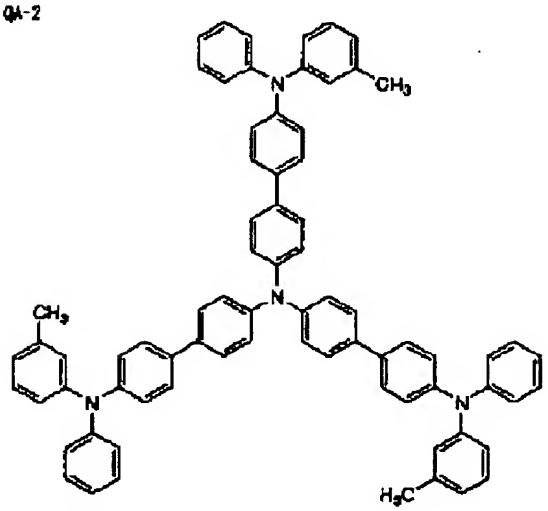
[0227]EXAMPLE (9-2) — doria — performance comparison (evaluation as a hole transporting material) of a reel amine compound
The electroluminescent element (9201-9214) which changed only NPB which is a hole transporting material of the 1st layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) to the compound shown in Table 3 was produced.
[0228]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9201 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9201 to 100. A result is shown in Table 3.
[0229]
[Formula 63]

QA 1



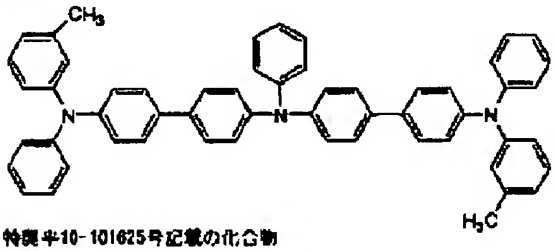
J.MATER.CHEM., 1992, 2(10), 1109-1110記載の化合物

QA-2



特開平10-312073号記載の化合物

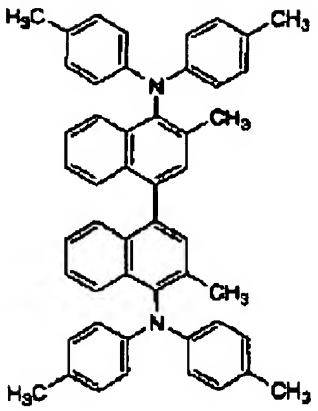
QA-3



特開平10-101625号記載の化合物

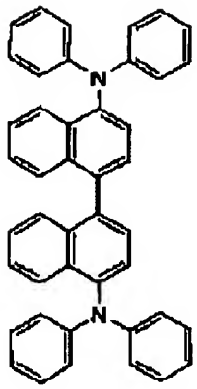
[0230]
[0231]
[Formula 64]

QA-4



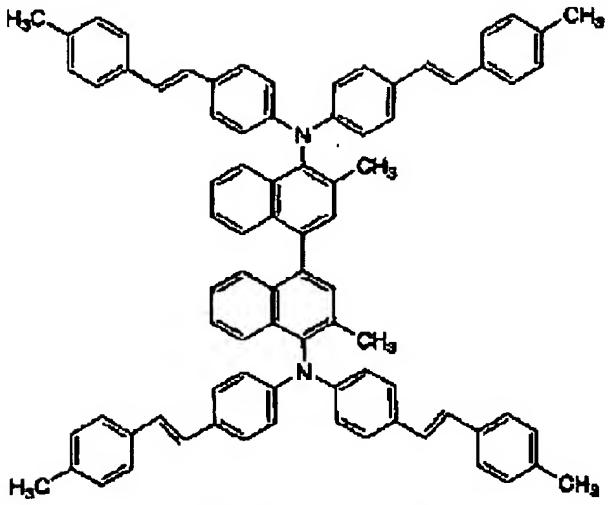
特開平11-152253号記載の化合物

QA-5



特開平11-152253号記載の化合物

QA-6



特開平11-152253号記載の化合物

[0232]
[Table 3]

No.	第1層の正孔輸送材料	発光輝度（相対値）	発色光	連続発光後の輝度半減時間（相対値）	備考
9200	NPB	124	青	77	比較例
9201	QA−1	100	青	100	比較例
9202	QA−2	103	青	112	比較例
9203	QA−3	97	青	87	比較例
9204	QA−4	95	青	110	比較例
9205	QA−5	90	青	103	比較例
9206	QA−6	87	青	108	比較例
9207	A−3	185	青	217	本発明
9208	A−5	181	青	256	本発明
9209	A−13	216	青	166	本発明
9210	A−6	190	青	201	本発明
9211	A−18	211	青	175	本発明
9212	A−19	237	青	211	本発明
9213	F−1	222	青	215	本発明
9214	F−12	210	青	201	本発明

clear from Table 3 — as — the doria of this invention — light emitting luminance is high and the luminescence life of an element also understands a long time for each sample (No.9207-9214) which uses a reel amine compound as a hole transporting material of an electroluminescent element again.

[0233]For example, by compound-A-3 of this invention which has three bond axes, it turns out that there are twice [about] as many light emitting luminance as this and a more than twice as many life as this to the sample (No.9201) which uses N,N,N-tri-p-terphenyl amine (QA-1).

[0234]three or more doria — to the sample (No.9202, 9203) using QA-2 and QA-3 which have a reel amine portion, three doria — it turned out that the light emitting luminance and the life of the direction of the sample (9209) which uses the compound (A-13) of this invention which has three C_2 axes of symmetry in intramolecular with a reel amine portion are high.

[0235]Similarly it compares with comparison compound-Q A-4 and QA-5 and QA-6 which are benzidine (naphthidine) derivatives, It turned out that high light emitting luminance and a long luminescence life are compatible in the electroluminescent element to which compound-A-6 of this invention, A-18, A-19, and F-1 used it for the electron hole transporting bed.

[0236]that is, the doria of this invention which has a beer reel group which has two or more ATOROPU bond axes in intramolecular — generally a reel amine compound, Compared with the compound which does not have a beer reel group with an ATOROPU bond axis, or it has only one piece, in the electroluminescent element which used it for the hole transporting material, an electron hole transportation function is high and, in the life, a long time became further clear from this result.

[0237]EXAMPLE (9-3) — doria — performance comparison (evaluation as a hole transporting material and luminescent material) of a reel amine compound

EXAMPLE (9-1) — and in creation of the electroluminescent element of (9-2), the organic electroluminescence (9300-9312) considered as the 1st layer (electron hole transporting bed and luminous layer) and 3rd-layer (electron transport layer) two-layer composition shown [way / similar] in Drawing 102 was produced except not vapor-depositing the 2nd layer (luminous layer).

[0238]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9301 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9301 to 100. A result is shown in Table 4.

[0239]

[Table 4]

No.	第1層の正孔輸送材料兼発光材料	発光輝度（相対値）	発色光	連続発光後の輝度半減時間（相対値）	備考
9300	NPB	63	青	92	比較例
9301	QA-1	100	青	100	比較例
9302	QA-2	15	青	95	比較例
9303	QA-3	58	青	82	比較例
9304	QA-4	89	青	108	比較例
9305	QA-5	72	青	93	比較例
9306	QA-6	211	青	90	比較例
9307	A-3	312	青	191	本発明
9308	A-5	256	青	209	本発明
9309	A-13	271	青	181	本発明
9310	A-6	288	青	200	本発明
9311	A-18	270	青	182	本発明
9312	A-19	279	青	218	本発明
9313	F-1	277	青	210	本発明
9314	F-12	245	青	232	本発明

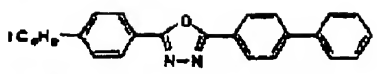
[0240]Table 4 shows — as — comparative doria — although it turns out that each reel amine compound (NPB and QA-1 - QA-6) becomes a hole transporting material and luminescent material, in any case, light emitting luminance is low short-life again.

[0241]the doria which has in intramolecular two or more beer reel groups which have an ATOROPU bond axis of this invention to it — in the electroluminescent element using a reel amine compound, it turned out that it may be compatible in high light emitting luminance and a long life.

[0242]

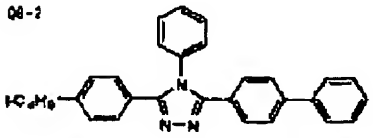
[Formula 65]

QB-1



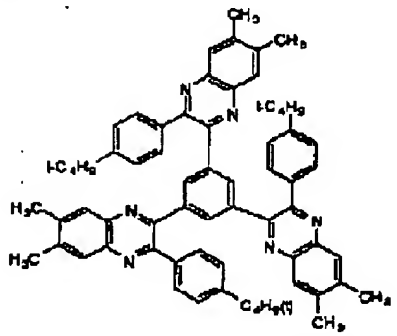
Appl. Phys Lett ,55, 1489(1989)記載の化合物

QB-2



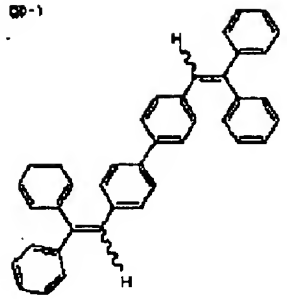
Jpn. J. Appl. Phys. ,32, L917(1993)記載の化合物

QC-1



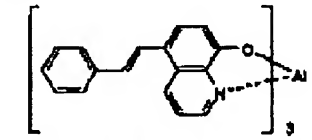
Macromolecules,31,8434(1998)記載の化合物

QD-1



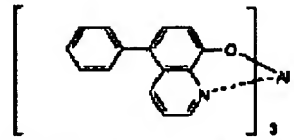
Appl. Phys. Lett. ,67,3853(1995)記載の化合物

QE-1



特開平9-255666号記載の化合物

QE-2



特開平10-251489号記載の化合物

[0243]EXAMPLE (9-4) — performance comparison (evaluation as an electron transport material) of 5 member heterocyclic compound

The electroluminescent element (9401-9411) which changed only OXD-7 which is an electron transport material of the 3rd layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) to the compound shown in Table 5 was produced.

[0244]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9401 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9401 to 100. A result is shown in Table 5.

[0245]

[Table 5]

No.	第3層の電子輸送材料	発光輝度（相対値）	発色光	連続発光後の輝度半減時間（相対値）	備考
9200	OXD−7	121	青	128	比較例（CF−1）
9401	QB−1	100	青	100	比較例
9402	QB−2	103	青	131	比較例
9403	B−3	144	青	417	本発明
9404	B−1	133	青	325	本発明
9405	B−7	149	青	401	本発明
9406	B−9	153	青	377	本発明
9407	B−2	134	青	445	本発明
9408	B−8	149	青	468	本発明
9409	B−6	138	青	481	本発明
9410	B−10	144	青	381	本発明
9411	F−3	133	青	447	本発明

[0246]The sample (No.9403-9411) which uses 5 member heterocyclic compound of this invention as an electron transport material of an electroluminescent element so that clearly from Table 5, As for all, improvement in light emitting luminance was accepted compared with the sample (9200, 9401, and 9402) produced using the conventional electron transport material. The luminescence life of an element has also been improved very greatly. Although such an effect (setting especially to the life of an element) is fully demonstrated also in 5 member heterocyclic compound (B-1, B-3, B-7, B-9, B-10) of this invention which has one beer reel group with an ATOROPU bond axis in intramolecular, The tendency for the effect to become more remarkable was also accepted in 5 member heterocyclic compound (B-2, B-8, B-6, F-3) of this invention which has a beer reel group which furthermore has two ATOROPU bond axes in intramolecular.
[0247]EXAMPLE (9-5) — performance comparison (evaluation as an electron transport material and luminescent material) of 5 member heterocyclic compound compound
In creation of the electroluminescent element of EXAMPLE (9-4), the organic electroluminescence (9500-9511) considered as the 1st layer (electron hole transporting bed) and 3rd-layer (electron transport layer and luminous layer) two-layer composition shown [way / similar] in Drawing 103 was produced except not vapor-depositing the 2nd layer (luminous layer).

[0248]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9501 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9501 to 100. A result is shown in Table 6.
[0249]
[Table 6]

No.	第3層の電子輸送材料兼発光材料	発光輝度（相対値）	発色光	連続発光後の輝度半減時間（相対値）	備考
9500	OXD−7	135	青	122	比較例
9501	QB−1	100	青	100	比較例
9502	QB−2	142	青	128	比較例
9503	B−3	312	青	388	本発明
9504	B−1	252	青	376	本発明
9505	B−7	388	青	321	本発明
9506	B−9	400	青	381	本発明
9507	B−2	501	青	401	本発明
9508	B−8	522	青	443	本発明
9509	B−6	477	青	450	本発明
9510	B−10	344	青	312	本発明
9511	F−3	479	青	405	本発明

[0250]The sample (No.9503-9511) which uses 5 member heterocyclic compound of this invention as an electron transport material and luminescent material of an electroluminescent element so that clearly from Table 6, As for all, compared with the sample (9500, 9501, and 9502) produced using the conventional electron transport material, the large improvement in light emitting luminance was accepted. The luminescence life of an element has also been improved very greatly. Although such an effect (setting especially to the life of an element) is fully demonstrated also in 5 member heterocyclic compound (B-1, B-3, B-7, B-9, B-10) of this invention which has one beer reel group with an ATOROPU bond axis in intramolecular, The tendency for the effect to become more remarkable was also accepted in 5 member heterocyclic compound (B-2, B-8, B-6, F-3) of this invention which has a beer reel group which furthermore has two ATOROPU bond axes in intramolecular.
[0251]EXAMPLE (9-6) — performance comparison (evaluation as an electron transport material) of 6 member heterocyclic compound
The electroluminescent element (9601-9605) which changed only OXD-7 which is an electron transport material of the 3rd layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) to the compound shown in Table 7 was produced.
[0252]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting

start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9601 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9601 to 100. A result is shown in Table 7.

[0253]

[Table 7]

No.	第3層の電子輸送材料	発光輝度(相対値)	発色光	連続発光後の輝度半減時間(相対値)	備考
9601	QC−1	100	青	100	比較例
9602	C−1	131	青	312	本発明
9603	C−2	165	青	283	本発明
9604	C−3	133	青	340	本発明
9605	C−8	167	青	401	本発明

[0254]As for all, compared with the sample (9601) which the sample (No.9602-9605) used as an electron transport material of an electroluminescent element produced using the conventional electron transport material, improvement in light emitting luminance was accepted in 6 member heterocyclic compound of this invention so that clearly from Table 7. It turned out that the luminescence life of an element is also improved very greatly.

[0255]EXAMPLE (9-7) — performance comparison (evaluation as an electron transport material and luminescent material) of 6 member heterocyclic compound compound

The 2nd layer (luminous layer) of the electroluminescent element (9601-9605) produced by EXAMPLE (9-6) was removed, and the organic electroluminescence (9701-9705) considered as the 1st layer (electron hole transportation) and 3rd-layer (electron transport layer layer and luminous layer) two-layer composition was produced. The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9701 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9701 to 100. A result is shown in Table 8.

[0256]

[Table 8]

No.	第3層の電子輸送材料兼発光材料	発光輝度(相対値)	発色光	連続発光後の輝度半減時間(相対値)	備考
9701	QC−1	100	青	100	比較例
9702	C−1	140	青	280	本発明
9703	C−2	209	青	221	本発明
9704	C−3	139	青	321	本発明
9705	C−8	205	青	310	本発明

[0257]The sample (No.9702-9705) which uses 6 member heterocyclic compound of this invention as an electron transport material and luminescent material of an electroluminescent element so that clearly from Table 8, As for all, compared with the sample (9701) produced using the conventional electron transport material, the large improvement in light emitting luminance was accepted. It turned out that the luminescence life of an element is also improved very greatly.

[0258]EXAMPLE (9-8) — the compound C-9 of example this invention of use of others of 6 member heterocyclic compound compound as a fluorescence dopant, Compared with conventional Quinacridone and N,N'-dimethyl Quinacridone (DMQA), it turned out that high light emitting luminance and a long life are attained by concomitant use with luminescent materials, such as Alq_3.

[0259]In the compound C-6 of this invention, it turned out that it becomes a luminescent material which emits light to yellowish green.

[0260]EXAMPLE (9-9) — performance comparison (evaluation as a luminescent material) of a stilbene compound

The electroluminescent element (9901-9908) which changed only Zn(BOX) 2 which is a luminescent material of the 2nd layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) to the compound shown in Table 9 was produced.

[0261]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the light emitting luminance at the time of a lighting start (cd/m^2) and luminosity was measured. Light emitting luminance was expressed with the relative value when light emitting luminance of sample No.9901 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.9901 to 100. A result is shown in Table 9.

[0262]

[Table 9]

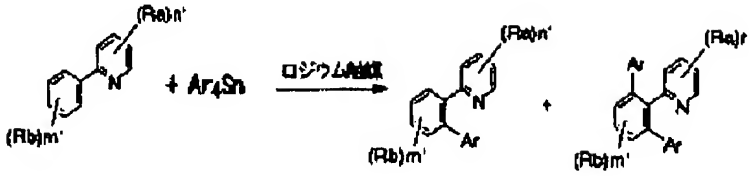
No.	第2層の発光材料	発光輝度(相対値)	発色光	連続発光後の輝度半減時間(相対値)	備考
9901	QD−1	100	青	100	比較例
9902	D−1	122	青	140	本発明
9903	D−5	125	青	134	本発明
9904	D−8	131	青	142	本発明
9905	D−12	140	青	125	本発明
9906	D−11	158	青	155	本発明
9907	D−2	205	青	212	本発明
9908	D−4	212	青	209	本発明

[0263]As for all, compared with the sample (9901) which the sample (No.9902-9908) used as a luminescent material of an electroluminescent element produced using the conventional luminescent material, improvement in light emitting luminance was accepted in 5 member heterocyclic stilbene compound of this invention so that clearly from Table 9. The luminescence life of an element has also been improved greatly. Although such an effect is fully demonstrated also in the stilbene compound (D-1, D-5, D-8, D-11, D-12) of this invention which has one beer reel group with an ATOROPU bond axis in intramolecular, The tendency for the effect to become more remarkable was also accepted in the stilbene compound (D-2, D-4) of this invention which has a beer reel group which furthermore has two ATOROPU bond axes in intramolecular.
[0264]EXAMPLE (9-10) — performance comparison (evaluation as an electron transport material and luminescent material) of a metal complex system compound
Zn(BOX) 2 which is a luminescent material of the 2nd layer of the electroluminescent element (CF-1) produced by EXAMPLE (9-1) is changed to the compound shown in Table 10, The electroluminescent element (91001-91008) of the two-layer composition of the electron hole transporting bed (the 1st layer) which removed the electron transport layer of the 3rd [further] layer, and an electron transport layer and luminous layer (the 2nd layer) was produced.
[0265]The continuous light by 15V direct-current-voltage impression was performed under the temperature of 23 **, and a dry nitrogen gas atmosphere by having used as the negative pole the counterelectrode which consists the ITO electrode of these elements of the anode, magnesium, and silver, and time to halve the luminous efficiency (lm/W) at the time of a lighting start and luminosity was measured. Luminous efficiency was expressed with the relative value when luminous efficiency of sample No.91001 was set to 100, and time to halve luminosity was expressed with the relative value which set time to halve the luminosity of sample No.91001 to 100. A result is shown in Table 10.
[0266]
[Table 10]

No.	第2層の電子輸送材料兼発光材料	発光輝度(相対値)	発色光	連続発光後の輝度半減時間(相対値)	備考
91001	QE−1	100	オレンジ	100	比較例
91002	QE−2	140	黄	150	比較例
91003	E−1	312	黄緑	329	本発明
91004	E−6	421	黄緑	411	本発明
91005	E−7	235	黄	307	本発明
91006	E−10	329	黄緑	311	本発明
91007	E−11	544	緑	289	本発明
91008	F−5	551	黄緑	423	本発明

[0267]The sample (No.91003-91007) which uses the metal complex system compound of this invention as an electron transport material and luminescent material of an electroluminescent element so that clearly from Table 10, Compared with the sample (91001 and 91002) produced using the conventional material, luminous efficiency was fitness (since a luminous wavelength was not able to compare with difference light emitting luminance greatly, comparison with luminous efficiency was performed) in each case. It turned out that the luminescence life of an element is also improved greatly.
[0268]2-aryl phenylpyridine derivative expressed with the general formula (N1) of typical synthesizing method this invention of the compound of this invention, It is compoundable by Shuichi Oi, Susumu Fukita and YoshioInoue Chem.Comumun., 1998, and the method indicated to 2439-2440.
[0269]In addition, typically, composition of various compounds which have a binaphthyl group of this invention is compoundable by a synthetic pathway as shown in the scheme 2 - the scheme 5.
[0270]next, the doria of this invention by the course shown by the scheme 4 as the example of representation — the synthetic example of reel amine (A-18) is shown.
[0271]
[Formula 66]

スキーム1



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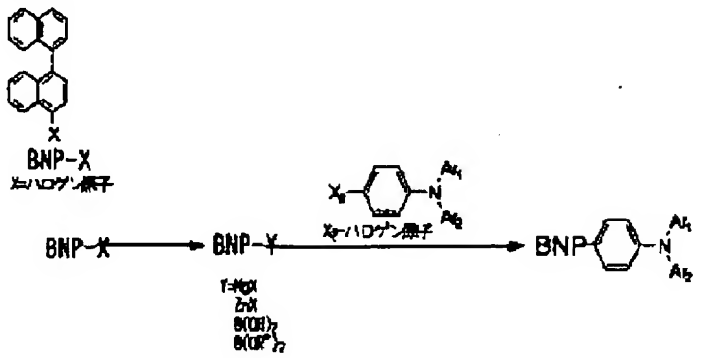

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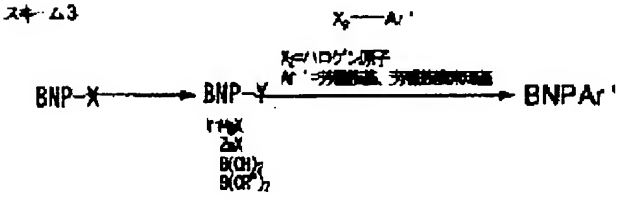

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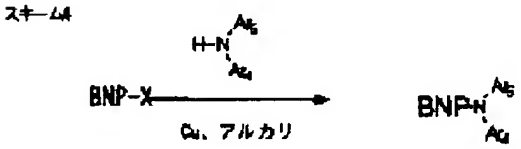
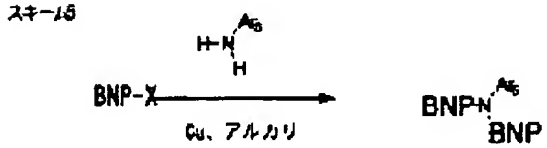


スキーム5



[0272][The synthetic example 1]
The 4-bromo- 1, 1'-binaphthyl Composition of [the compound XX]: The solution which dissolved 50 g (197mmol) of 1,1'-binaphthyl in 600 ml of methylene chlorides within a 2000-ml 4 mouth flask, and diluted 3.4 ml (65.6 mol, 1/3 Eq) of bromine with the methylene chloride 10 times in the ice bath was dropped. It added the bromine solution 2 times at a time 1/3-Eq further, having sampled the solution after the end of dropping and checking conversion with high performance chromatography. After agitating at a room temperature after that one whole day and night, it distilled off under decompression of a solvent. The 4-bromo- 1 and 43.9 g (67.0%) of 1'-binaphthyl were obtained by performing recrystallization for the obtained rough product from acetonitrile, and performing suspension washing twice with methanol further.
[The synthetic example 2]
Composition of N,N'-diphenyl-N,N'-binaphthyl benzidine [compound-A-18] : In a 500-ml 3 Thu mouth flask, the 4-bromo- 1 and 10 g (30.0mmol) of 1'-binaphthyl, 4.73 g (34.2mmol) and 25 ml of nitrobenzene were put in for 0.48 g (7.50mmol) and potassium carbonate, and 5.05 g (15.0mmol) of N,N'-diphenylbenzidine and copper powder were agitated at 200 ** for 30 hours. Toluene after ending reaction was added, it filtered, and the inorganic substance was removed. Subsequently, rinse a filtrate, dry with magnesium sulfate and a solvent is distilled off, 5.40 g of N,N'-diphenyl-N,N'-binaphthyl benzidine was obtained by carrying out separation refinement with the silica gel column chromatography using a toluene-hexane mixed solvent (65.0mmol, 43.0%).

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]The tectonic profile of an electroluminescent element

[Translation done.]

* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]

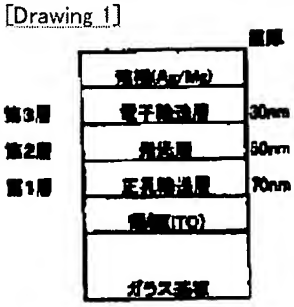

図101 有機EL素子の構成断面図

[Translation done.]